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Technical Editor. C. O. BRETTELLE, M.I.E.E. *Joint Managing Director:* E. A. GATEHOUSE, M.I.E.E., A.M.INST.C.E. *Commercial Editor.* A. H. BRIDGE.

Manager and Secretary: E. S. MIDDLETON.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

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Radiology.

IT has always been our declared aim to present, within the limits of practical possibilities, a review of the electrical situation as it exists from time to time. The range covered by this reference is a very wide one and includes branches of engineering with only an associative connection with electricity, such as the mechanical engineering aspects of power stations.

Some branches of electrical science present few opportunities for treatment in the technical Press and probably do not at any time receive the public acknowledgment to which their merits in the promotion of general well-being would appear to warrant. Thus, while the importance of the applications of electricity to medicine and surgery entitle them to a leading position in electrical work, we hear little of them compared with other applications of no greater value, a paper like that read by Mr. Bernard Leggett before the I.E.E. last March being exceptional.

This year we follow what has been our custom for many years past in using the occasion of the annual congress and exhibition of the Institute of Radiology to present a survey of the year's progress in the design of X-ray apparatus. The report of the exhibition prepared for us by MR. E. H. W. BANNER (which is concluded in the present issue) indicates a continuance of tendencies noted in previous years. Thus in connection with control gear it is apparent that the "dual control" fitted by some makers last year has come to stay, and it is now supplied with most makers' apparatus. Broadly speaking, for diagnostic work in surgery, X-rays are used for two purposes —screening and radiography. The former requires a high voltage, small current, and a relatively long time of application, whilst radiography requires generally a larger current for a shorter time. Before the advent of dual control it was necessary for the operator to set his controls for the values of voltage and current required, and then to reset both controls for taking a photograph. Dual control provides for separate control for voltage and current for both purposes, with either a change-over switch for switching from "screening" to "radiography" or a more elaborate device by which the change-over is effected automatically by the mere pressing of the appropriate switch. It is now becoming

usual to transfer all controls to a trolley table on which all instruments are mounted, although in some apparatus such instruments as a milliammeter and a spark-gap are still fitted on the main plant. Spark-gaps are rapidly becoming obsolete; they serve very little purpose with present-day apparatus, but they are spectacular and may perhaps provide a selling point. When spark-gaps are used spheres are usual, although there are still a few point-to-point gaps to be seen.

All of the firms in the British X-ray industry exhibited and also several film makers and other incidental trades. In addition, representative apparatus was shown by American, Dutch, and German firms. It is pleasing to find that there is now a self-protected British X-ray tube on the market; until this tube appeared the vast majority of tubes were made either under Coolidge (American) patents or "Metalix" or Muller (Continental) patents. British rectifying valves have been obtainable for many years, so that it is no longer essential for apparatus makers to purchase either X-ray tubes or valves from abroad.

The main features of the present exhibition may be summarised by saying that, while it included a few quite new features, these embodied nothing of so revolutionary a nature as characterised the advent of the hot-kathode or thermionic X-ray tube, or the great change in outlook noticed some three years ago when numerous items of equipment, mainly on the engineering side, were completely redesigned to be more in keeping with needs arising out of the greater power now available. These improvements have been continued each year, and the present is no exception, although all makers do not progress at the same rate; while it is easy to pick out sets that appear very little different from those of a few years ago, the majority are entirely different as regards the design of the generating plant.

British Motor Prices.

IN our "Correspondence" columns during the last month or so various views have been expressed upon the subject of the prices of electric motors. MESSRS. E. P. ALLAM & CO., LTD., initiated the discussion by suggesting that, as compared with the cost of petrol and gas engines doing the same work, the prices charged by British motor manufacturers were ridiculously low—too low, in fact, to make the business profitable to the manufacturers and distributors. Inevitably, the next correspondent, "SALES ENGINEER," pointed out that the cost of the motor was not the only cost—a pulley and starter being required. With this adjustment the price difference was not so marked, and could be accounted for by the fact that electric motors were better adapted to mass production than i.c. engines, and, moreover, the demand was increasing, further decreasing manufacturing costs. Messrs. Allam then said that the low cost was due to deliberate price-cutting and the effect upon the product was disastrous. They advocated a better job at a better price.

This brought in the question of foreign competition, the NORMAND ELECTRICAL CO., LTD., showing that it was the consumer who fixed the price by threatening to turn to the foreign product if the British manufacturer would not come down to the foreign price level. The company maintained, however, that British motors were still superior, and that British makers who were satisfied with a reasonable profit and discountenanced price-cutting were still far from bankruptcy. "INSPECTOR" approved of the basis which the Normand Company put forward as the fair means of fixing prices, and then diverted the correspondence into another track by suggesting that guarantees were often worthless. To this, another manufacturer of small motors—POWER CONTRACTS (BATWIN), LTD.—replies in this issue that faulty material or workmanship will show up in three months; therefore the usual twelve-months' guarantee is ample. It also maintains that a conscientious firm will always stand behind its products whether a fault develops within the guarantee period or later.

The position disclosed appears to be as follows: British manufacturers of electric motors do not have to meet the competition of i.c. combustion engines, but that of foreign electric motor makers. If their prices are fixed at too high a level they lose business to the foreigner; if at too low a level they must eventually go out of business altogether. It seems, however, that they are able to sell cheaply and make a living by efficiency of production. Low prices mean a smaller discount per unit to the distributor, but the demand, being fostered by low prices, should expand, enabling more units to be sold. As regards guarantees, we think that a reputable firm will stand behind its products; the others should not last long in such a competitive market, where not only low prices, but also a high standard of performance, can be insisted upon.

All-electric-home Costs.

WE have had occasion in the past to draw attention to the lack of reliable statistics as to the costs of running all-electric homes. In our "Electricity for the Home" section in both this and our last issues may be found a wealth of information bearing on this subject, with actual figures obtained for residences of various sizes from a servantless five-room flat to a large London house of fifteen or so rooms in which a staff of servants is employed.

Two notable features of these statistics are the opportunity afforded to arrive at what are economic rates of electricity supply for all-electric service, and the support given to the advocates of thermostatic control for room warming.

The Fulham Inquiry.

IN our issue of December 5th we drew attention to the absence of any proposals for transmitting into London at a reasonable cost an amount of electrical energy equivalent to the output of the proposed power stations at Battersea and Fulham.

The reason for the non-existence of such proposals will, we think, be evident from the evidence given last week by MR. H. HOBSON and MR. J. R. BEARD on behalf of the Central Electricity Board at the inquiry into the application of the Fulham Borough Council to extend its generating station.

The additional costs worked out for the cheapest method of transmitting 300,000 kW into London from a point down the river, even supposing the method to be practicable—which we doubt—provides in our view an effective reply to critics of the scheme.

The Mission to Egypt.

LAST week MR. G. M. GILLETT, the Parliamentary Secretary of the Department of Overseas Trade, announced the Government's intention to send a Trade Mission to Egypt. This is the fifth mission of its kind. The first, of which Sir Hugo Hirst, Bt., was a member, examined the conditions in Australia. Others went to South America and South Africa, while at present a mission, in which Col. R. K. Morcom is included, is making a study of Far Eastern markets.

The fact that Sir Arthur Balfour is chairman of the Egyptian Mission makes it certain that the investigation will be a thorough one and that the mission's report will be a useful and suggestive document. Sir Arthur Balfour presided over the Committee on Industry and Trade, which was appointed in 1924 and produced a series of reports which made a searching analysis of industrial and commercial conditions and put forward many fundamental proposals. The electrical industry may feel aggrieved at the absence of a representative from the personnel, but the fact remains that unless these missions are to be abnormally large, and consequently unwieldy, several important industries must remain unrepresented directly. There is, however, a good deal of electrical business to be done in Egypt, as the expanding imports have shown, and we trust that the mission will give due attention to that aspect of the Egyptian situation.

The Radiological Exhibition.

Continuance of improvement in design, without radical departure from current practice, the general adoption of dual control of X-ray apparatus, and a British self-protected tube.

By E. H. W. BANNER, M.Sc., A.M.I.E.E., A.Inst.P.

(Concluded from page 1040.)

A large 200-kV set shown by Schall & Son comprises a rectifying equipment of two rectifiers and two smoothing condensers, the resulting voltage wave-form ripple being about 5 per cent.

An example of a modern control table is given in fig. 13, where Messrs. Newton & Wright's dual-control

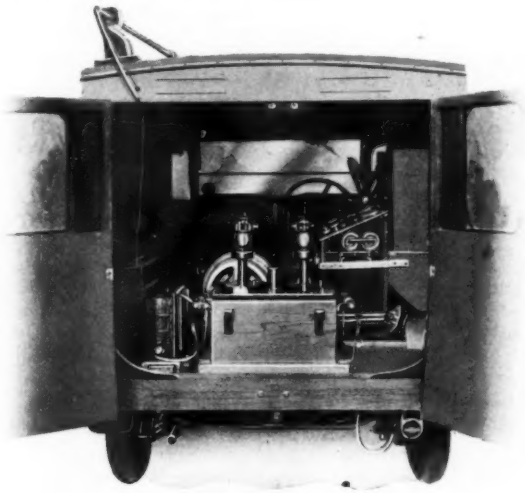


Fig. 6.—Mobile Set Mounted in Car.

trolley table is illustrated. Installations such as that shown in fig. 7 by Messrs. Cox Cavendish are not common. The whole plant is self-contained, the controls being fixed to the apparatus cabinet instead of being on a trolley. A self-rectifying tube is used, and it will be seen that the set serves for both over- and under-couch work, as well as for vertical use. Fig. 8 shows a simple portable set by Messrs. Stanley Cox; the transformer carries the tube, which is self-rectifying, and a separate case contains the controls, including the auto-transformer. Voltage control is provided for the range 60 to 90 kV. The set is rated at 90 kV, 30 mA. The business-like mobile set shown in fig. 6 is made by X-rays, Ltd. When erected, it is capable of dealing with both vertical and horizontal couch work. The car contains a fully-equipped dark room and a generator of 2.7 kVA driven directly from the engine. The output is about 90 kV and 30 mA, a self-rectifying X-ray tube being used.

A portable set of the trolley type is made by Messrs. A. E. Dean & Co. The transformer is contained in the cabinet, the controls are on the front of the sloping top, whilst the rear of the top carries insulators leading away the e.h.p. current through a milliammeter in the main circuit and a filament ammeter in the X-ray tube circuit. It will be noted that both these instruments are in the e.h.p. circuit, and so require electrical screening to prevent brushing and flash-over. Actually special cases are used, called "anti-corona," in which all external surfaces are well-rounded edges, points being avoided. Voltage control is in three steps —55, 65, and 75 kV. With the set may be used a self-protected tube or a Coolidge tube in a box, the tube actually being on the trolley and projecting to the rear of the table. The tube shown was an Andrews "Protexray." This firm also exhibited a 4-valve set recently re-designed, using British rectifying valves by Newton and Wright; the usual dual-control and trolley are parts of the new set.

The "Protexray" tube of Cuthbert Andrews is the first British hot-kathode or thermionic tube marketed, although the firm has made gas tubes for many years, and it is interesting to note that there is still sufficient demand for gas tubes to keep one man continually occupied in their manufacture. Fig. 10 shows the general appearance of the 3-kW water-cooled model as now made, the first model of the "Protexray" tube having been exhibited in 1928. The vacuum is appreciably lower than that obtaining in a Coolidge tube. Both radiator and self-cooled tubes are made in sizes for dealing with 3 and 6 kW, whilst larger water-cooled tubes can deal with 6 and 10 kW. These ratings are all based on an exposure of one second and on a rectified circuit, but if no other rectifier is used the maker does not recommend the use of over 90 kV peak. If the target is appreciably warm from a previous exposure the loading in kV x mA x seconds should be reduced by 25 per cent., but the above term should not be held to be rigid, as the product of the three units may be increased somewhat as the time is reduced. Thus, it is found that it is more efficient to use a tube near its maximum load for a short period instead of a smaller load for a longer period.

The Philips "Metalix" valve is shown in section in

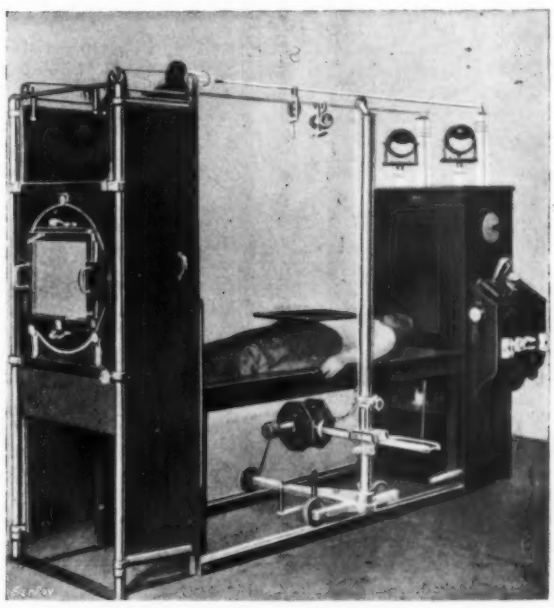


Fig. 7.—Self-contained Plant.

fig. 12, where it will be seen that the anode is completely exposed to the air, a fact which leads to efficient cooling, helped by the fins which form an integral part of it. The use of black glass results in absence of light emission, which is a useful feature. The almost complete surrounding of the filament by the anode leads to

a lower voltage drop; in general, it is about half the drop in a glass valve. In addition to the specialities mentioned, the following were also exhibited by the various firms referred to in each case. Messrs. Newton & Wright, Ltd., showed a simplified couch for supporting a patient,

Fig. 8.—" Autogram " Portable Set.

with a tube above or below, including leads to the X-ray tube below the couch in the form of concentric tubes, the high-voltage lead being inside and away from contact with patient and operator. Rectifiers have been made

Fig. 9.—Cable-testing Plant, 132 kV.

for the trade for some years, and each is guaranteed for one year. Mechanical rectifier sets are also made, but as is the case with other makers also the sale of these is declining. Control tables generally are as previously described, namely, all metal, with instruments at or near earth potential and dual control. This firm made a large three-phase set for the Middlesex Hospital some years ago designed for treatment work at 250-kV peak, 10 mA.

Some electro-medical equipment, as well as X-ray apparatus, was on show, in particular diathermy apparatus. This consists of a high-frequency generator,

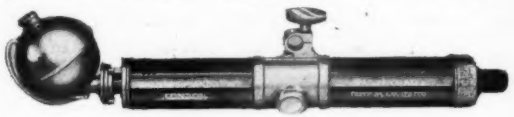


Fig. 10.—The " Protexray " Tube.

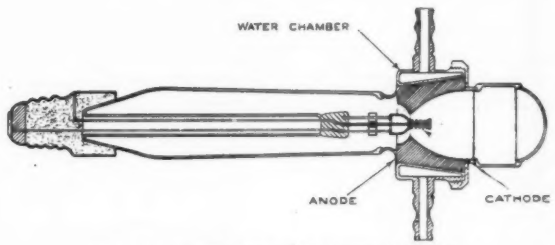


Fig. 11.—The New " Grenz " Tube.

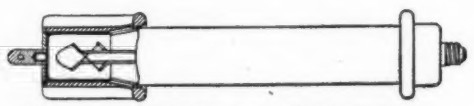


Fig. 12.—Section of " Metalix " Valve.

usually of the spark type and operating at frequencies of from one to four million cycles per second. These, too, have been improved in design of late years, the latest being the valve generator of Messrs. Phillip Creswick, shown last year. This set follows the lead of wireless in the displacement of the spark generator by the three-electrode valve. A lamp emitting invisible

Fig. 13.—Trolley Ward Unit.

infra-red rays was shown by Messrs. Cox Cavendish, and other lamps for ultra-violet-ray treatment were exhibited by several firms.

The supply to an X-ray tube being high-pressure unidirectional current, with or without smoothing,

applications to purposes other than that of the generation of X-rays present themselves, one of the obvious uses to an engineer being for cable testing. X-rays, Ltd., lists several sets for this purpose and, although these were not actually on view, they merit sufficient interest to have attention drawn to them. Fig. 9 shows a two-valve set designed for voltages up to 132 kV and suitable for testing all types of single-core or multi-core cable; the set consists of transformer units built up for cascade connection.

On the stand of the Medical Supply Association electro-medical apparatus was predominant, including apparatus for supplying direct current (galvanism) and interrupted current (faradism), together with rhythmic interrupting gear, &c. The newer apparatus works from a.c. mains with a double-anode rectifying valve. Ultra-violet lamps of the arc and mercury-vapour types were shown. The X-ray equipment included a single-valve set for 100 mA output.

Automatic time switches are now common with most sets; the need for these becomes imperative with the advent of high power and consequent short exposures. A new model by the General Radiological and Surgical Apparatus Co. gives automatic exposures down to 1/100 of a second, and as very short exposures involve a very few cycles it is necessary to arrange for synchronisation so that the same point on the wave may be switched on each time; otherwise the resulting output from the transformer would be different for successive exposures.

The elimination of rheostats from the main transformer controls is now a general feature; this firm also applies it to their filament transformer controls, a contact arm sliding directly on the primary winding.

Messrs. Watson & Sons (Electromedical), Ltd., exhibited diathermy sets up to 400 W output, intended for both medical and surgical (cautery) work. Their four-valve X-ray set has been redesigned, and a one-valve and two-condenser set has been shown in fig. 5. A new set of apparatus shown for the first time by this firm is the stabiliser for mains use. It consists of a system of transformers, chokes, and condensers, some of the chokes saturating so that, with a large fluctuation of input voltage, the secondary fluctuation is small. A demonstration with an artificial line-voltage varying device showed a secondary voltage variation of about 2 per cent. for about 50 per cent. variation of primary voltage. The stabiliser is intended for the control of the filament current of the X-ray tube where a small variation results in a relatively large change in tube current.

Another new exhibit was a Grenz ray generator. Grenz rays consist of very soft rays having wave-lengths between 1 and 3 A.U., and generated by about 4 to 12 kV. The rays are extremely soft and are half absorbed by about half a millimetre of skin. The tube is somewhat like an X-ray tube, but is smaller, as it has to deal with lower voltages; owing to the softness of the rays, a window for their emission from the tube is made of Lindemann glass. Fig. 11 shows a section of the tube.

The portable set of Messrs. Philips Lamps, Ltd., shown last year has been extended in application by the provision of a small generator for driving from a motor-car in cases where no electric supply is available. The generator is mounted on a bedplate and geared to rollers, which are engaged by one of the rear wheels of the car, no jacking up of the rear axle being necessary.

A dosimeter reading directly in R units for determining when a predetermined quantity of X-radiation has been administered was also shown by this firm. Briefly, it consists of an ionisation chamber containing an electrometer, which is charged by a local supply and discharged by receiving the radiation being measured. Successive discharges operate to show on a dial the number of R units received. A self-contained radium element provides a means of checking calibration when required.

Generally speaking, it may be said that this year's exhibition does not stand out from among others of the series by virtue of any remarkable innovation, and that trends noted in previous years have been satisfactorily developed.

A Safe Lathe-dog.

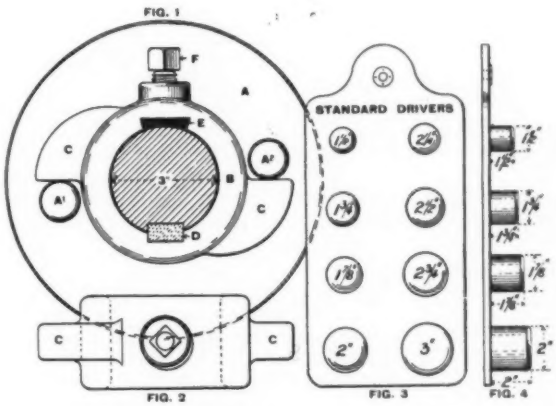
Particulars of a practical method of gripping shafts.

By J. T. TOWLSON.

MEANS for gripping machined shafts, such as the finished shafts of motors, generators, and the like of all diameters are various, but the writer knows of none so useful and safe as that shown in the accompanying sketch.

Those familiar with the work of tightening up and returning commutators of motors and generators will know that for such operations the armature shafts need to be held very tightly by some kind of carrier, driver dog, or clip; this is not infrequently effected by placing a rough piece of steel at the key-way at the pulley end of the armature, and gripping the shaft and the piece of steel with rough clips, &c.

Such means, it is true, are effective, but being very rough they might seriously injure a machined shaft. The writer, designer of the lathe " dog " described, having turned and supervised the turning of commutators, has found it highly satisfactory in practice.



Figs. 1 and 2.—Shaft Set up in Lathe. **Figs. 3 and 4.—Hangers for Lathe-dogs.**

Referring to the drawings, fig. 1 represents the pulley end of an armature, or of any machined shaft with a key-way in the end. A¹ and A² are the usual driving pins fixed diametrically opposite in the catch-plate of a lathe. B is the lathe " dog " referred to, and is cast in steel, the bore of the particular dog shown being 3 in. CC are the driving horns of the " dog," another view of which is given in fig. 2. D is a standard key-piece, well fitting in the key-way of the armature-shaft, and conjointly in the keyway cut in the " dog." E is a safety pad of copper, or of soft brass, and easily renewable, and this pad is gripped to the shaft by the set screw F.

Figs. 3 and 4 show a substantial board hung in a handy place in the shop, having wood plugs, with sizes cut in and blacked, on which the dogs are hung when not in use. The front ends of these wood plugs are well radiused, and so are the edges of the bore of each particular dog. Such radiusing of the bore of the dogs not only prevents damage to the " dogs," but gives an easy entrance of the plugs into the dogs when being hung up.

Previous to the adoption of this device in an electrical machine-shop damaged shafts were common, but now they are quite the exception, while the endurance of the " dog " is considerable.

A Diversified Industry.

Some Strange and Apt Occupational Terms.

By G. E. MOORE.

GOVERNMENT publications and Blue Books are not, generally speaking, regarded even by students and the like as worthy objects for study. Yet much useful matter, often collected and made available at great cost, may be found therein. Such a one is the imposing "Dictionary of Occupational Terms"; it is issued by the Ministry of Labour, and its compilation must have entailed much patient work. This weighty book has a glossary of more than twenty-nine thousand different ways of earning a living. On every page one is astounded by the variety of jobs possible, and by the number of occupations which one never suspected or which (to say the least) are indeed strange and diverting. For instance, there are such queer trades as *barley-sugar twisting*, *blood-collecting*, *lead-digesting*, and even *egg-breaking* (at the which must surely be more amateurs than professionals!); while apparently there are such mysterious figures in industry as *wuzzers*, *swissers*, *can-wallopers*, and *cheese-winders*. The name is no criterion of the nature of a worker's job, for a *pulpit man* is a foundry worker, a *woffler* repairs scales, and a *fat boy* toils in a quarry.

The electrical industry is represented by a goodly variety of workers; for instance, under the direct classification of "electric" and the like may be counted over one hundred occupations. Most of them are self-explanatory. One did not know that some existed: others merely seem ridiculous by reason of meticulous or over-stressed differentiation. And the ordinary reader (accustomed only to workaday peculiarities in his own "line") will find a certain number of eccentric electrical trades.

An *electrical engineer* is defined as "a trained and qualified technical man either employed in design and construction of electrical plant and apparatus, or (in a supervisory capacity) in control and operation of electrical plant and apparatus in service." A *wireless engineer* is introduced as "an electrical engineer (*q.v.*) skilled in the installation, maintenance, and repair of wireless apparatus . . ." and such duties as the erection of aerials, testing for faults, and the like are enumerated.

A specific definition of duties may, in these days of specialisation, be easy and accurate. Yet in such an instance as the following particularisation seems somewhat futile and ridiculous: a "*meter maker, meter fitter, electrical meter maker, electrical meter fitter* is an instrument maker (*q.v.*) who screws, solders, insulates and puts together component parts of electric meters, using screwdrivers, files, pliers, spanners, soldering bits, varnish brushes, and by replacing worn or defective parts."

The name of the *electrician* is legion. He may be a chief, assistant, or merely an ordinary electrician, or he may be an "*electrician-in-chief* (cable ship)"; and his duties may be indicated as appertaining to cable ship, film producing, factory, house, rolling stock, seagoing, theatres and music halls, or tramways; he may possess an assistant, an "*assistant* (film producing)," a labourer, or a mate; while, although "*electrician* (Post Office)" is duly given a place, he is not officially recognised in P.O. classification—one gathers that he is a somewhat sheepish employé lurking timidly in the background. A rather curious term—*circuitman*—caught the writer's attention: apparently *his* job consists of clearing line faults, but, like the last-mentioned unfortunate, he is not recognised!

Of wiremen and linesmen, electric light makers, electrical signal men, testers, metermen, wire coverers, winders, clock men, magneto hands, instrument makers, electrolytic workers—of each of these, and the like, there are several kinds set forth. And (of course!) one meets various forms of inspectors, including even an inspector of fuse boxes; while of the different "*examiners* (viewers)" one bears the title of *wire overlooker*. There is naturally a great number of different assemblers; in one place at least the assembler is quaintly though accurately referred to as a "*putter-together*," but that figure in workshop life—the expert with the putting-on tool—is absent.

Naturally, there is a great number of specific electrical workers. One would not have imagined that many of these existed, but upon glancing down the varied list one at once appreciates the necessity for them. The ramifications of the electrical industry are impressive. While this is not the place to describe, or even merely indicate, the numerous relevant occupations there are many curious jobs which (to the average reader) are interesting or unusual enough to mention here.

Some of the uncommon occupational terms explain themselves. One notes, for example, that there are *carbon brush copperers*, *accumulator* (*i.e.*, *plate*) *sawyers*, *third-rail repairers*, *armourers* (of cables), *mica gaugers*, *electrical primers* (ammunition), and *cord examiners* (telephones). The *electrical furniture maker* is found to be allied with *electrical ware* or *electrical fittings maker*. An impressive individual is the *electrification ganger*. *Sample maker* (cables) must be important, for his work (which consists in preparing short lengths of cable for exhibition) is minutely described. The *tar-boiling man*, whose work is in connection with the coating of armoured cables, seems familiar, but the writer must confess that he has never met the *firepot boy*—who attends to linesmen's portable fires.

Lamp-making appears to involve a unique variety of terms, such as the *collarer*, the *cap fixer*, the *burner-in* (or *sealer*); while the duties of the *gauger* (who weighs filament lengths) and the *ager* (more readily recognised as *flash-ager*) are carefully described at length. An incidental worker—the *gas and candle fittings adapter*—is rather significant, and we are told that by means of the lathe, screwing tools, and brazing tackle he alters and adapts gas and candelabra fittings to suit electric light.

The familiar "sparks," then, fills many rôles. Yet one feels conscious that, comprehensive though the list of occupational terms may be, there must be many gaps. This is inevitable, for not only is the industry continually growing and in some cases adapting or overlapping non-electrical work, but there must obviously be no end to the specific jobs that are possible and the local or general names that may be coined. In this there is much to cheer and hearten everybody—save only the compilers of such a work as the "Dictionary of Occupational Terms." Whether the writer did not study the mighty book closely enough, or whether the persons in question are over-modest, it is impossible to say, but he did not encounter the makers of electrical combs, magnetic belts, or galvanic corsets. However, the Dictionary shows that there is nothing to stop one of these benefactors masquerading as somebody else. Concluding, he regrets that in a staid work like the Dictionary no place could be found for those technical colloquialisms which enliven and even enrich industrial life.

Electricity Supply in Paris.

Details of a Typical Outdoor Transforming Station on the High-voltage Interlinking System.

By CHAS. J. WEBB, A.I.A.E.

IT will be recalled that recent negotiations have culminated in the supply of electricity in the Paris area being now entirely in the hands of two groups, one consisting of the Union d'Electricitè and the other of the Compagnie Parisienne de Distribution d'Electricitè and the Société d'Electricitè de la Seine. As the result arrangements are now in progress for linking the distributing systems of the various power stations (fig. 1) and, as part of that work, the last-named company has recently completed a 10,500/60,000-V transforming sub-station at Conflans, just beyond the south-eastern limits of Paris. Normally the sub-station transmits power to the Nation sub-station at the east-end of Paris, whence it is distributed for general lighting and power purposes and also partly for traction purposes on the Paris underground electric railway. The Conflans station is also linked with one at Villejuif, while both are connected to one further south, at Chevilly, which eventually will act as a receiving station for hydro-electric power transmitted from central France.

The Conflans sub-station, which was constructed by the Société Parisienne pour l'Industrie des Chemins de Fer et des Tramways Electriques, is of the out-door type and comprises six 21,500-kVA transformers built by the Société Savoisienne de Constructions Electriques of Aix-les-Bains as the sub-contractor. These transformers are of the self-cooled type (fig. 2) and are arranged in two groups of three; on the incoming side they are fed by five lines at present taking power from the generating station at Ivry, and on the 60,000-V side there are seven transmission lines: two running to the power station at St. Denis to the north of Paris, two to the Nation sub-station, and three to that at Villejuif. A double set of bus-bars is provided on both the 10,500- and 60,000-V sides. The plant has been so designed that the number of incoming feeders may be eventually increased to five and those on the outgoing side to seventeen.

The 10,500-V apparatus has been installed indoors in ferro-concrete compartments designed to restrict the area of damage should an explosion occur at any time. The switches are enclosed in cabins entirely separated from each other, ready access to each being available from the outside of the building. The transformers are erected in the open air on massive blocks of cement let into the ground, while the apparatus is erected on, or supported from, ferro-concrete girders carried by pillars of similar material, the cost of which is stated to be less than that of steelwork.

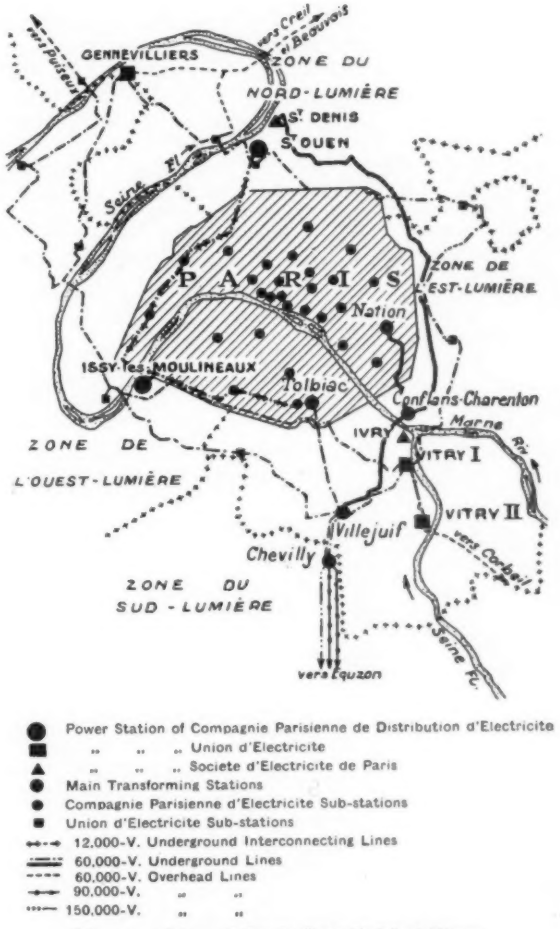


Fig. 1.—Map of Paris Interlinking Lines.

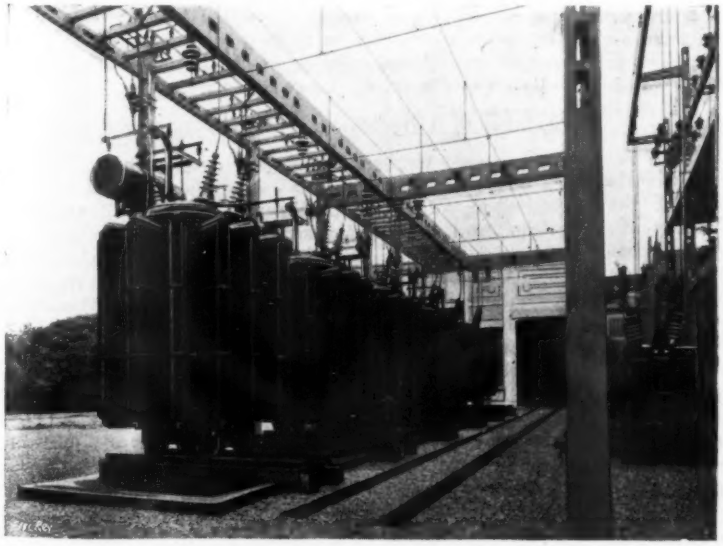


Fig. 2.—The Conflans 10,500/60,000-V Sub-station.

The 10,500-V feeders, which are each capable of transmitting a load of 21,500 kVA, consist of three three-core cables of 200 sq. mm. section. In order not to have to put a complete feeder entirely out of circuit in the case of a fault or breakdown of the line, sectionisers are provided by means of which any one of the three cables can be cut out. The ends of the feeders are protected by triple-pole switches having a rupturing capacity of a million kVA. The two groups of transformers are connected to the control board by three-conductor armoured cables.

The transformers each comprise three 7,166-kVA self-cooled elements. The primaries are delta and the secondaries star connected, the neutral being connected to earth; the 60,000-V switches have a rupturing capacity similar to those on the 10,500-V side. Means are provided on the control board for simultaneous isolation on both the incoming and outgoing sides. The two feeders running to the Nation sub-station are protected by switches having a rupturing capacity of 1,500,000 kVA. Each is provided with two sets of metering devices contained in the same compartment, there being two current transformers and two potential transformers. The two feeders extending to the St. Denis power station have one-million-kVA switches, but have so far not been equipped with metering instruments. The 10,500-V bus-bars are fitted with means for registering the total active and reactive power transmitted. In addition, a record of the average power delivered is automatically made every fifteen minutes by means of "Maxigraph" instruments. The feeders running to the St. Denis power station and the Nation and Villejuif sub-stations are equipped with the Dupuy-Tinel-Fallou system of bi-directional differential relay protection.

The supplementary services of the Conflans sub-station are furnished by two 10,500/220/127-V transformers. The installation also comprises a 40-ton travelling crane for handling the transformers, an oil-treating plant, and a special transformer for oil testing at up to 80,000 V.

A Note on Electrical Theory.

The relationship between its pure and applied aspects, with especial reference to the importance of mathematical methods.

By G. WINDRED.

THE exact nature of the relation between the mathematical theory of electricity and magnetism and the branches of applied theory having their foundation therein has hitherto received but slight attention. It is evident that the understanding of applied electrical theory is much assisted by a knowledge of the fundamental theorems of electricity and magnetism, as developed for the purpose of mathematical treatment, and it follows that the study of theoretical principles has an important connection with modern utilitarian development. In the present paper an attempt is made to outline the development of the more important theorems with a view to indicating their connection with modern practice.

The difficulties encountered by modern theorists are often traceable to discrepancies in matters of fundamental detail. In view of the present scope of electrical theory, it is admittedly difficult to discern tenable principles, which alone must be relied upon to carry the complete theoretical structure, but the fact that further progress depends largely upon such discernment is manifest. For this reason it seems highly necessary to give due consideration to theoretical principles.

It is an unfortunate fact that the practical engineer tends to regard the mathematician somewhat askance, as though his researches had but the slightest connection with practice. This idea is entirely erroneous, and tends to prevent progress. It must be remembered that electrical theory is a mathematical science—an exact science founded and dependent upon mathematical principles; its rapid progress has been largely due to the high state of development of mathematical analysis prior to the fundamental discoveries of the eighteenth and nineteenth centuries. It is no less important to bear in mind that greater truth than is represented by the assumptions on which a calculation is based cannot appear in the result.

The Experimental Researches of Faraday.

It would be difficult to over-estimate the importance of Faraday's researches in electricity and magnetism. They may be regarded as forming the groundwork upon which the mathematicians responsible for the present state of electrical theory have based their inquiries. Faraday's discovery of electromagnetic induction stands, in itself, as one of the greatest discoveries of science. The experiments leading to this discovery were inspired by the hope of discovering some analogy between the effects of electricity in motion through a circuit and static electricity. On August 29th, 1831, Faraday wound two coils of wire on to opposite sides of a soft-iron ring, connecting one coil to a battery and the other to a galvanometer. It is described in Faraday's own words that: "When the contact was made, there was a sudden and very slight effect on the galvanometer, and there was also a similar slight effect when the contact with the battery was broken. But whilst the voltaic current was continuing to pass through the one helix, no galvanometrical appearance nor any effect like induction upon the other helix could be perceived." [1]

Arrangements have already been made by the Royal Institution, where Faraday worked for many years with Sir Humphry Davy, for the recognition of the centenary of this great discovery. In 1833 Faraday introduced a new terminology which has persisted to the present day: involving the notion of two *electrodes*, a *cathode* and an *anode*, to which there flowed *cations* and *anions*, respectively. The process of electricity generation in a battery he termed *electrolysis*. Faraday's researches in electricity were published in a number of journals, including the *Proceedings* of the Royal Institution, the *Philosophical Magazine*, and the *Quarterly Journal of Science*. They were reproduced in various forms from about 1831 to 1857, and most editions of the "Experimental Researches in Electricity" are now rare.

Mathematical Development of Faraday's Discoveries.

Among the mathematicians who developed the work of Faraday, the foremost was James Clerk Maxwell, who studied Faraday's "Experimental Researches" at Cambridge and determined to interpret them in mathematical language. It is indeed fortunate for electrical theory, and the practical developments which are the outcome thereof, that Maxwell was not only a trained mathematician of high order, but was also capable of putting the results of experiment into mathematical form—a by no means ordinary ability which enabled him to put the ideas of Faraday before his mathematical contemporaries. Maxwell's famous "Treatise on Electricity and Magnetism" was published in 1873 and was probably commenced about 1865, in which year Maxwell resigned his professorship of natural philosophy at King's College, London, and returned to his estate in

[1] From the description presented to the Royal Society on November 24th, 1831.

Scotland. In 1871 he returned to Cambridge as the first Cavendish Professor of Experimental Physics.

To all except trained mathematicians familiar with the methods of the Cambridge school, Maxwell's work is of extreme difficulty. There is an explanatory volume,[2] now long out of print, by Sir J. J. Thomson, at one time Cavendish Professor at Cambridge.

The first of Maxwell's attempts to interpret mathematically the conceptions of Faraday, and to establish a mechanical conception of the electromagnetic field, was communicated in a memoir to the Cambridge Philosophical Society.[3] In the first part of this paper Maxwell identifies Faraday's lines of force with the lines of flow of a liquid and shows that on this analogy the magnetic induction is expressible as the velocity of an incompressible fluid. The memoir is of considerable mathematical interest as containing the first indication of the physical significance of the vector operators *curl* and *div* which had been used some years before, notably by Sir G. G. Stokes, but in a purely mathematical connection.

Maxwell's researches were contemporary with those of Sir W. Thomson (afterwards Lord Kelvin) from whose writings he obtained many valuable suggestions. At the hands of Maxwell was developed a complete electromagnetic theory[4] embodying the results of his many researches and extending the electromagnetic theory of light to an investigation of the optical properties of crystals.

The practical importance of electromagnetism requires no demonstration. In answer to the question as to what constitutes the most important experimental discovery in electricity we should probably be correct in suggesting electromagnetic induction, the discovery of Hans Christian Oersted, of Copenhagen, in July, 1820. From his experiments, comparatively simple in principle, has grown a branch of electrical theory essential to the development of electrical machinery and apparatus. Once again it required the assistance of the mathematician to develop this discovery, and this assistance was given by Biot, Savart, and Ampère very shortly after the appearance of Oersted's paper describing his experiments. Ampère's investigation, which is of an advanced mathematical character, is among the classics of applied mathematics. It contains, in addition to the first conception of the "magnetic shell" which has proved of great importance in electromagnetic theory, an expression for the force between two elements of circuits carrying currents. Maxwell has said of this memoir that: "It is perfect in form and unassailable in accuracy; and it is summed up in a formula from which all the phenomena may be deduced, and which must always remain the cardinal formula of electrodynamics."

Electromagnetic Wave Theory.

The theory of signalling by cable has its origin in a correspondence between Stokes and Kelvin in 1854. Extension of the work of Kelvin on this subject was made in 1857 by Kirchhoff, who showed that the electromagnetic disturbance is propagated along the cable with a definite velocity c. The value of this constant had been determined some little time previously by Weber and Kohlrausch, who showed by comparing two different methods of discharging a Leyden jar that $c = 3.1 \times 10^{10}$ cm./sec., approximately. It is interesting to note that this is closely similar to the then accepted value of the speed of light as determined by astronomical investigations. The average of three independent sets of observations for determining the velocity of propagation of electromagnetic waves in air—Trowbridge and Duane (1895), Saunders (1897), and Maclean (1899—is 2.997×10^{10} cm./sec. The most accurate measurement of the velocity of light, by Michelson in October, 1924, gives the value 2.99735×10^{10} cm./sec., with a possible error of one in 22,000.

The close agreement between the velocity of light and the calculated velocity of electromagnetic waves was regarded by Maxwell as a strong reason for believing that light is an electromagnetic phonemenon, and to Maxwell is due the electromagnetic theory of light. This cannot be said to possess any practical utility, but we must remember that it is closely bound up with the theory of relativity, on the significance of which it is at present impossible to speculate.

A number of mathematicians became interested in the equations of wave propagation. Among them was Oliver Heaviside, whose investigations are at last beginning to receive the attention which is their due.[5] Heaviside's mathematics were unorthodox; nevertheless he had a great capacity for difficult analysis, and evolved new mathematical theorems for the solution of his problems with extraordinary facility. His investigations of eddy-current phenomena are highly important. He obtained a solution of the problem of an infinitely long solid cylinder with its axis parallel to a uniform alternating field of force, and generalised Lamb's observations on eddy currents, showing that rapidly alternating currents do not penetrate far beneath the surface of any conductor. It is unnecessary to enlarge upon the practical importance of eddy-current phenomena. They are of significance in high-frequency circuits and arrestor circuits, and provide many problems in connection with electric traction.

We have remarked that Heaviside's methods of analysis were unorthodox. He was very fond of vectorial analysis, and we are of the opinion that this fact played an important part in the success of his methods. This type of analysis is not fostered in England, but is especially popular in Germany, where it has formed the basis of the mathematical speculations leading to the theory of relativity at the hands of Riemann and Christoffel.

Not only in the higher branches of mathematical physics, but also in engineering calculations, graphical and vectorial methods are of importance. This is especially so with electrical theory, in many branches of which the theory of complex quantities has rendered possible the solution of problems presenting serious difficulties to the application of analysis. Most students of alternating-current theory are familiar with the advantages arising from the use of trigonometrical methods applied to vector diagrams, and it is reasonable to expect that similar advantages follow the use of vector algebra. Vector analysis was largely employed by Maxwell in developing his equations for magnetic and electrostatic potential. In his *Treatise* Maxwell uses German capitals to denote vector quantities, and Greek or Roman letters for their components. He also employs the analysis of Quaternions originated by Sir W. R. Hamilton, which, in its original form, requires an entirely special terminology, and has not survived in its application to physical problems. For the majority of practical purposes the theory of complex quantities forms a sufficiently powerful means of analysis; it is suited to the representation of two-dimensional conditions, and is therefore useful in analysis of two-dimensional problems in hydrodynamics and electrical theory.[6]

[2] Published at Oxford in 1893. It contains valuable additions to the theory, and in particular elaborates Faraday's conception of "tubes of force," to which the whole of the first chapter is devoted. There are valuable chapters on electric waves and oscillations, and the distribution of rapidly alternating currents.

[3] Trans. Camb. Phil. Soc., X, p. 27.

[4] "A Dynamical Theory of the Electromagnetic Field," read before the Royal Society in 1864, and published in the "Phil. Trans.," clv., 1865, p. 459.

[5] Strangely enough, this appreciation comes mainly from abroad. In America has been published a short work entitled "Heaviside's Operational Calculus," by E. J. Berg, wherein the electromagnetic theory and system of operators used by Heaviside are explained. See also L. Cohen, "Heaviside's Electrical Circuit Theory." In this country Heaviside's methods have received the attention of J. R. Carson, Van der Pol, and the late Dr. T. J. I'A. Bromwich, of Cambridge. See the paper by D. P. Dalzell, "Heaviside's Operational Methods," Proc. Phys. Soc., 42, February, 1930, p. 75.

[6] For a discussion of Laplace's equation in this connection, see the author's paper on "The Complex Number and its use in Electrical Theory," the *Electrician*, August 17th and 24th, 1928. See also "Electrical Circuit Theory based on the Method of Complex Numbers," *ibid.*, April 5th and 12th, 1929.

Electrical Circuit Theory: the Work of Kennelly.

Next following Maxwell and Heaviside the most important investigators of electrical circuit theory are Steinmetz and Kennelly, both of America. Kennelly was the first to introduce the use of complex quantities into electrical circuit theory, and is thus responsible for a great advance in this subject. In his paper on "Impedance," read before the American Institute of Electrical Engineers on April 18th, 1893,[7] he showed that any combination of resistances, inductances, and capacities in an alternating-current circuit might be treated as subject to Ohm's law if the inductances and capacities were considered in the form of complex quantities of opposite sign, the algebraic operations being carried out in accordance with the rules of complex algebra. In 1894 appeared a paper by Kennelly "On the Fall of Pressure in Long Distance Alternating Current Conductors,"[8] in which the first application of complex *angles* and complex hyperbolic functions to electrical circuit theory was made. Part of this investigation is based on the solution first published by Heaviside of the differential equations representing the distribution of potential and current on electrical lines. These equations appear in Heaviside's "Electromagnetic Theory,"[9] but without suggestion of a vectorial solution. It is interesting to note that Kennelly's analysis is a further example of vectorial methods. These have been collected into a systematic whole by Kennelly and published under the title of "The Application of Hyperbolic Functions to Electrical Engineering Problems."[10]

The Work of Steinmetz.

The writings of Steinmetz are of important status in electrical literature, and of considerable interest from a mathematical point of view. They may be regarded as purely utilitarian, being almost entirely concerned with problems arising from engineering practice.

To discuss the methods of Steinmetz in the light of the classical electrical theory would be to make an unwarranted comparison. There is a very marked, but seldom recognised, difference between the classical analysis and the calculations associated with engineering practice. The latter are almost invariably based upon results obtained from the higher analysis, except in cases in which the data are of empirical origin. An important example of an empirical law is afforded by Steinmetz's formula for the loss of energy by hysteresis in magnetic materials. Steinmetz showed that this loss is proportional to the 1.6th power of the flux density, to a considerable degree of exactness. The well-known equation[11] expressing this result is of great use in practical calculations.

One of the most important subjects to which Steinmetz contributed in his writings is the theory of complex quantities in their practical application. His first paper on this subject was read before the International Electrical Congress of Chicago in August, 1893, and carried the title of "Complex Quantities and their use in Electrical Engineering."[12] In this paper he extended the field of application of complex quantities, and showed for the first time that the corresponding mathematics embraced Kirchhoff's laws. In his subsequent textbooks he did much to extend the applications of complex methods.

Steinmetz clearly recognised the fact that the graphical methods of analysis then in common use left much to be desired in point of accuracy. He points out[13] that, whereas the graphical method is the best for deriving a clear insight of the problem, it suffers from inaccuracy on account of the widely different magnitudes which usually have to be represented. It is in connection with the latter point that the value of vector algebra lies.

The conceptions of admittance, conductance, and susceptance which Steinmetz frequently employed are of great value in many branches of alternating-current theory. Used in conjunction with the theory of complex quantities they form a very powerful means of analysis. Certain difficulties are occasionally introduced by complex methods, especially in relation to expressions for power, and care is necessary in the expression of double frequency or otherwise heterogeneous quantities in this manner.

Since a sine wave is amenable to complex expression, the advantages of this method extend to alternating-current wave theory, wherein it is very useful in the calculation of harmonics and power values in complicated circuits.

Steinmetz's electrical papers are very numerous, and cover practically every branch of applied theory. His textbooks of electrical engineering are also comprehensive, even if not always comprehensible, and the majority have passed through several editions—the surest indication of their practical value. Here again we might stress the fact of Steinmetz's partiality to vectorial methods, and to the particular branch of mathematics so well suited to their development.

Conclusion.

The foregoing brief review of the progress of electrical theory has included a large number of subjects, and many investigators. The treatment we have been able to give in the space available is, however, of a very cursory nature, and must be regarded as the merest introduction to the subject. It is nevertheless hoped that some indication has been given of the importance of mathematical methods, and of the fact that, without the mathematicians of the nineteenth century, progress in electrical theory, and in the applications to which it gives rise, would have been of a very different order.

400,000-V Röntgen-ray Tube.

At a recent meeting of the French Academie des Sciences in Paris, Mr. A. d'Arsonval described a new Röntgen-ray tube capable of working at 400,000 V. It was in 1913 that Mr. W. D. Cooledge invented the type of tube in which the electronic current is produced by emission from an incandescent cathode. Up to 1928 it was considered that 200,000 V was the maximum which such a tube could withstand, although Cooledge had already produced a tube working at up to 350,000 V and two- and three-stage tubes for from 600,000 to 900,000 V, while later experimental tubes for pressures up to one million volts in fifteen stages had been produced. Mr. d'Arsonval pointed out that all those advances had, however, been confined to research laboratories, and that so far there was no systematic production of tubes for 400,000 V. The new d'Arsonval incandescent-cathode tube is a sealed single-stage bulb, which, at a constant voltage of 400,000 V, carries 2 milliamperes, while with a pulsating voltage of 400,000 V it will carry an average of 2.5 milliamperes. This has been achieved by mounting the cathode filament within a round metallic component, the air in which is, by extending the exhausting action, entirely withdrawn. The new tube is being manufactured by the Gaiffe-Gallot and Pilon Co., of Paris, and is made in lengths up to 43.5 in. with bulb diameters of from 190 to 200 mm. The distance between the anode and cathode is 40 mm., and the diameter of the metallic sleeve 25 mm.

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[7] Trans. A.I.E.E., April, 1893, Vol. X., pp. 175-216.

[8] The *Electrical World*, of New York, Vol. XXIII, pp. 17-19. January 6th, 1894.

[9] Vol. I, pp. 451-452. On this subject, see the correspondence in the *General Electric Review*, Vol. XXVII, pp. 132-133, February, 1924.

[10] Third edition, London University Press, 1925.

[11] See Steinmetz, "Theory and Calculation of Alternating-current Phenomena," 5th Edition, Art. 98.

[12] Proc. Int. Elec. Congress, A.I.E.E., 1894, pp. 33-74 (see also pp. 24 and 25).

[13] "Alternating Current Phenomena," 5th ed., Art. 25.

Export Trade's Lighter Side.

The Romance and Humour of the "Missed Chances."

By A. J. S.

TO the outsider there is something disquieting about the complaints that are voiced so regularly about the manufacturer and his methods in export trading. Are all our manufacturers so devoid of commonsense, and is the history of export trading merely a tragic tale of disregarded instructions and missed opportunities? Let the reader be reassured. The exporting manufacturer is by no means the ignoramus that might be supposed, and the business is by no means an unrelieved tragedy, but quite the contrary. Even in its worst moments it has its lighter side for those whose philosophy will permit them to see its rich humour.

The Foreign Exhibition.

For romance and colour we need not look further than the overseas exhibition. Who has not had his imagination aroused by the propaganda material of many such a gathering, where under blue and cloudless skies, in stately palaces a cosmopolitan crowd of buyers is to be seen besieging the stands of the enterprising exhibitors? How disappointing it is that prosaic facts should conspire to tone down and dim the high-lights of this attractive vista. Can it be that the promoters of such an attractive enterprise may be mistaken as to some of the essential facts upon which their appeals are based, and that, in short, they themselves have failed in preliminary "market research"? One of the most amusing instances of this attempt to ignore facts which were patent to every manufacturer with exporting experience, was in connection with an important exhibition in Southern Europe, lasting for four months, and supported by the government of the country in question. For months beforehand it was the object of a selling campaign on the part of the promoters of the exhibition, whose arguments would have proved to me without the shadow of a doubt the immensity of the market which lay ready to my hand there, except for the trifling fact that it was very well known in the trade that it had long been the deliberate intention of the country in question to exclude British products of this kind by steadily increasing the import duties every year or two until the import was entirely checked. At the time the exhibition was first launched, as a sure and certain means of "increasing British trade," the authorities had by means of duties, gold surcharges, sales taxes, and similar methods managed to add exactly 100 per cent. to the f.o.b. price of the goods by the time they had got through the Customs, and with a knowledge born of experience of the capabilities of the British manufacturer in surmounting every obstacle, they had a revised tariff and heavier surcharges in the background which it was officially explained would not be put into force until the exhibition was over! Something of the absurdity of the position must have at last become apparent even to the promoters and their official backers, as their unfortunate Ambassador was instructed to make a speech in which he explained how his Government's desire to promote British imports was perfectly consistent with a determination to do everything in its power by means of duties to exclude them.

The Foreign Representative.

Romance is also very apparent in many of the communications one regularly receives from prospective overseas representatives, particularly the one-man type of agency which, from a two-roomed suite of offices in some foreign trading centre, seeks the representation of British manufacturers "upon a commission basis" (plus a trifling allowance of three or four hundred pounds per annum for office expenses, travelling, or some such pretext). For the salesmanship of these commercial representatives, which is the means of a manufacturer acquiring their services at such a price, I have nothing but admiration; but in too many cases one finds that this preliminary selling success is the only one that can be put to their credit. For the subsequent and (for the manufacturer) more important work of selling his goods to buyers, the representative is usually sadly lacking. One such commission representative of my acquaintance when pressed for orders would periodically forward to his exasperated principals a list of names and addresses copied from a directory, with a request that a fully explanatory letter should be written to each, incidentally mentioning the agent's name and address. Another such representative whose methods I had an opportunity of investigating had adopted an even simpler selling method. Instead of going to the trouble of copying out names and addresses, he took the quicker step of purchasing various town directories, and forwarding these (with an invoice for the cost) to his disillusioned principals with the customary request that various possible buyers should be written to with catalogues, quotations, and full particulars. It is perhaps needless to add that any failure to comply with these simple requests is invariably given as the reason (if any reason be required!) for absence of business.

One may even come across fortunate representatives, in receipt of various allowances, who seem in spite of this to spend most of their time in this country. It may be argued that there are not many openings of this kind available nowadays, where substantial yearly allowances are made without any particular safeguard upon the value to be received in return. It is true that they are more difficult to obtain than ever, but it is the dream of every representative's life to secure a few agencies upon this basis, and as every manufacturer has to buy his experience in this line, one may still encounter a fortunate representative engaged in making the best of his various allowances while they last—for it is unfortunate from his point of view that they are seldom renewed for a second term.

The Official Investigator.

There is amusement as well as interest to be derived from many of the handbooks published from time to time with the object of showing how the manufacturer fails in this country and the other. The humour of the situation depends upon the fact that in so many of these cases the instructor is (if the truth were known) merely a novice engaged in explanations to the expert. Many of us when reading the pontifical censures of some of these investigators must have known something of the feeling of a particularly stupid schoolboy rebuked by an omniscient head. The real humour of the position, however, only begins to emerge when one has been afforded the opportunity of following the career of one or other of these advisers of the British manufacturer. The perusal of a 100-page report explaining where the British manufacturer fails in securing trade in Ruritania undoubtedly sharpens the latter's critical faculties if nothing else, if he happens to know that the author who complains so bitterly of the lack of knowledge of local conditions has himself only been in that delectable

country for a short time, that he has never in his life sold a pennyworth of goods there, and that his knowledge of the language is exactly on a par with that of the manufacturer he instructs, although his shortcomings in this respect may be compensated for by a typist or possibly a polyglot native clerk.

"Keen Buying."

There is humour in a comparison of the blunt English method of asking for a price on a printed inquiry form with the more subtle approach employed by the foreign buyer. A certain class of potential foreign buyer only comes to the point after he has first with the utmost skill created the proper frame of mind in the manufacturer. I regret to have to say that amongst the cynical the method is commonly described as "leading him up the garden path!" This type of buyer commences by painting a pretty pen picture of the amount of business there is to be secured by the manufacturer who will study the market; he then describes the immense amount of competition there is to be encountered; the unheard-of efforts that German (and French, and American) makers will go to in order to secure the smallest orders; he touches briefly upon the abnormally long credits that such competitors will grant in the normal course of business; and then after stating plainly that the manufacturer who wishes to secure business must be prepared to make great sacrifices for the first year or two, he asks for the price. I believe that many foreign inquirers consider this method to be unrivalled in securing keen quotations.

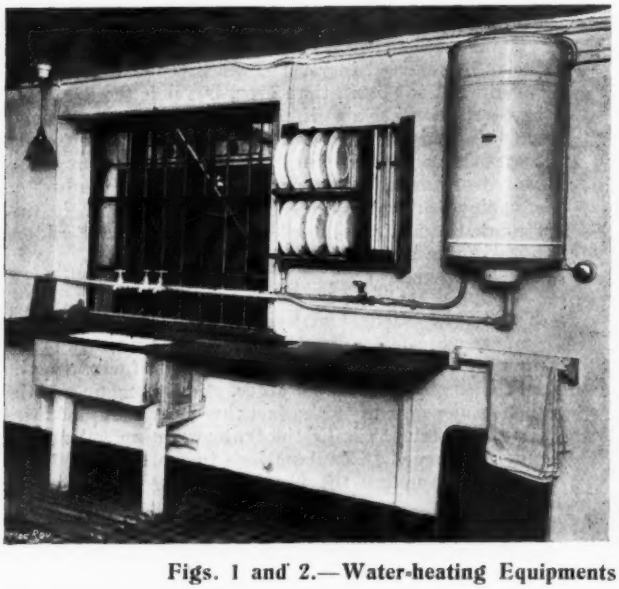
Another ingenious method of buying was that adopted by another overseas concern, which simply disregarded the manufacturer's prices altogether, and fixed its own prices on the order somewhat upon the following basis. The manufacturer's price for an article might be £100. The buyer simply said that the figure was absurd, and there must be some mistake, as he had had quotations for a better article from the American firms of X and Y at £60 and £70, respectively. He would, however, enclose an order for the goods on condition that it was executed and delivered c.i.f. at £72. Though such tactics could hardly serve for permanent business relations, there is little doubt that this buyer's occasional purchases were made at wonderfully keen prices.

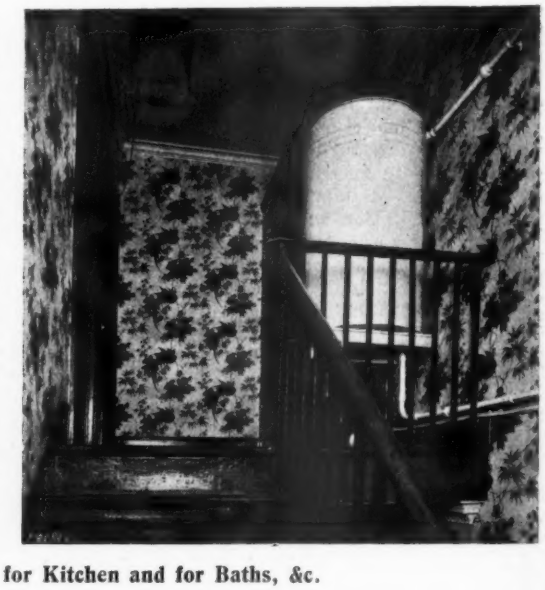
On the whole, there is nothing like actual experience of export trade to counter the popular "defeatist" impression which now so commonly attaches to it. To conduct such a trade successfully is an exacting undertaking, and if in most cases it now resolves itself into a battle of wits, it loses nothing of its utility on that account.

Electricity for the Home.

The following description and data concerning a large all-electric home are a conclusive argument for that type of installation.

TWO comparatively small houses in Kensington have recently been converted into one large house, and as it was necessary to rewire them, owing to the unsafe condition of the existing installation, the owner considered the possibility of an all-electric home. He was further encouraged owing to the fact that there was no central heating, and the domestic hot-water supply was inadequate and inconvenient, the two houses being supplied from different sources. It was found upon investigation that favourable rates were obtainable from the Kensington and Knightsbridge Electric Lighting Co., Ltd., that the first cost of an all-electric home was lower than the more usual arrangement of coke boilers for the central and domestic water heating, and that the estimated running costs for electricity were low, even if no allowance was made for the obvious advantages to be obtained by dispensing with stoking and the carrying of coal, with the attendant dirt and extra cleaning entailed.





Figs. 1 and 2.—Water-heating Equipments for Kitchen and for Baths, &c.

The house as it now stands has seven bedrooms, two nurseries, a dining room and a drawing room, two other small sitting rooms and the usual London basement. The family numbers three, and there are five servants, including a nurse, making eight people in all to be catered for. Details of the apparatus installed are given in Table I.

The following are also installed: a "Busy Bee" vacuum cleaner; two kettles; two irons; electric warmer; and since June last a "Busy Bee" refrigerator. The total connected load is approximately 40 kW.

The housemaid's cupboard and the lavatory are not in the same house as the large water heater, and it is probable that a small local heater to supply these services only would soon pay for itself by reducing the pipe losses involved in a necessarily long run. As the pipe run from an electric water heater cannot be on the circulating system, owing to radiation losses, the linen cupboard and towel rails are directly electrically heated. There is no great advantage in allowing for thermostatic control in passages and staircases, as any surplus heat assists in the general warming of the house, and the heaters can be switched off when not required. The thermostats are normally set at a temperature of 55 deg. F. Experience shows that this makes for a very comfortable room as a general rule and, if required, the temperature can be raised in a short time by supplementary heating in the form of either a coal or an electric fire.

Fig. 3.—Tubular Heaters in Dining Room.

A coal fire is used in the drawing room for æsthetic reasons, but plugs have been provided so that electric fires can be used at any time. The fires were selected with some care for their respective positions. The "Sunray" is particularly suitable for a dining room, as the source of heat is such that, although efficient, no screen is necessary to protect people sitting with their backs to the fire. Incidentally, the light from the fire is most attractive; fig. 4 gives an idea of the room at night, the firelight being supplemented by light from sconces. Usually the fire is the sole source of light, apart from candles on the table, and it is quite sufficient for ordinary requirements. The sconces are turned on when extra light is required at the sideboard or serving table. The large best bedroom used to be an "L"-shaped drawing room in one of the houses, and, as there is no furniture immediately in front of the fireplace, a Ferranti fire is installed; it is found in practice that one bar is usually sufficient to maintain a temperature of 60 deg. F., even on cold days. The "Inventum" fire in the large dressing room performs a similar service. The "Sullivan" fire is ideal for the night nursery, as the top element is hinged and can be used as a small cooker. A "Belling" fire efficiently heats the spare room.

The lighting installation is on normal lines and is carried out on the double "Stannos" system. Particular care has been taken to see that there are plenty of plugs, in order to avoid difficulty when furniture is moved, and the two-way switching on landings and staircases has been carefully thought out. There are altogether 87 lights and eight sets of two-way switches. Plugs have also been provided for the convenient use of the vacuum cleaner in the various rooms.

Although at present the supply is 200 V, d.c., there is a likelihood of a change-over to 230 V, 3-phase, a.c. in the near future, and in consequence the installation has been so divided that no extensive alterations will be required when this takes place. As no two-part tariff was available, and because of the nature of the installation, it would have been awkward to arrange to balance floor against floor. No. 1 phase will therefore feed the tubular heating and water heating, No. 2 the lighting, fires and power points, and No. 3 the cooking and kitchen lighting, the last named being separated from the main lighting circuit in order to avoid 400 volts between the cooker and the handlamp provided to facilitate the inspection of the oven. It is true that there will be two phases in the same room in places where the water and tubular heaters are installed, but these are rigidly fixed and bonded to the earthed sheathing of the wiring, and there is no possibility of any external metal becoming alive. Three-pin plugs are used throughout, interlocked for all purposes other than lighting, and all exposed metal, even on the sconces and pendants, has been earthed. Bakelite lampholders are used with fittings which are themselves insulators, and the whole installation is based on "insulate where possible, earth everywhere else."

Fig. 6 shows the main distribution equipment; the time switch visible on the extreme left controls the water and tubular heaters.

Fig. 4.—Lighting from Radiant Fire and Sconces.

In addition to the equipment already described, there is an electric bell system which incorporates house telephones from the drawing room, dining room, best bedroom, dressing room and day nursery, which have been found a great saving of labour, especially in the case of the nursery. A wireless set has been built into an old oak cupboard in the drawing room, and permanent wiring feeds loud-speaker outlets in the drawing room, dining room, nursery, and servants' hall.

The house was first occupied in its present form in June, 1929, so that a complete year's figures are available for the running costs. As will be seen from the consumption details, Table II, the central heating was

TABLE I

Position and service.	Type.	Rating, kW.	Remarks.
Kitchen, cooking ...	Jackson	10.0	Hired from Supply Co.
Kitchen, water heating	Inven um	1.0 (10 gal.)	See fig. 1
Top landing, water heating, 2 baths. H.M.C. & lavatory	,,	3.0 (55 gal)	See fig. 2
Pantry, water heating	,,	0.5 (4.5 gal)	
Bathroom 1, towel rail	Unity	0.2	
Bathroom 2, towel rail	,,	0.2	
Linen cupboard	,,	0.36	Thermostatically controlled
Front hall, central heating	,,	1.98	
Back hall, central heating	,,	1.62	
Garden room, 170 sq. ft., central heating	,,	1.12	
Drawing room, 300 sq. ft., central heating	,,	2.52	Thermostatically controlled.
Dining room, 300 sq. ft., central heating	,,	2.52	Thermostatically controlled. See fig. 3
Dining room, 300 sq. ft., intermittent heating	Sunray	1.0	See fig. 4
Best bedroom, 360 sq. ft., intermittent heating	Ferranti	2.5	See fig. 5
Dressing room, 225 sq. ft., intermittent heating	Inventum	2 0	
Spare room, intermittent heating	Belling	2.0	
Night nursery, intermittent heating	Sullivan	2.0	

the largest item, but the supply company has now agreed that the charge for this shall be ½d. per kWh in the future, provided a time switch cuts off both the tubular

Fig. 5.—A Bedroom Fire.

and water heating from 4 p.m. to 7 p.m. during the months of November, December, January, and February. This represents no hardship to the householder, as there is more than enough heat stored in the walls and furniture of a house which is never allowed to get cold to preclude an excessive temperature drop during these times.

The total kWh consumed was 30,988, and the total cost of electricity was £112 14s., or an average cost of 0.875d. per kWh. The meter and equipment rent for the four quarters was £11 13s. The total cost for the tubular heating was £36 2s. 4d., so that a saving of £18 would have been made if the ½d. rate for central heating had been in force at the time.

These figures show that the all-electric house, even on

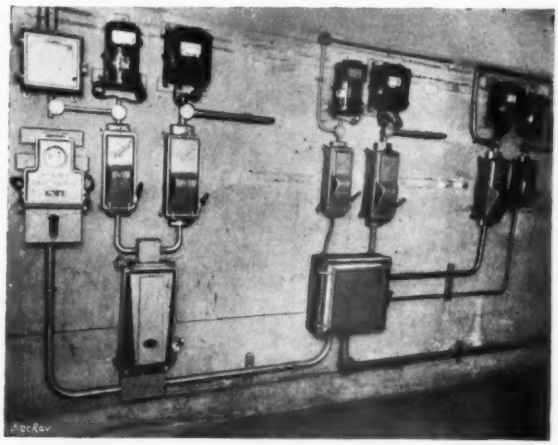


Fig. 6.—Main Distribution Board.

a fairly large scale, is by no means a myth, and that there is no doubt that the running costs of the house using coal and coke would have been little less than the actual figures obtained, assuming an equal degree of comfort, for the heating was not " spared " in any way.

TABLE II.

—	Sept. quarter, 1929.	Dec. quarter, 1929.	Mar. quarter, 1930.	June quarter 1930.
Lighting, ½d. per kWh	110 kWh (£2 1 3)	230 kWh (£4 6 3)	294 kWh (£5 10 3)	154 kWh (£2 17 9)
Cooking, 1d per kWh	1,260 kWh (£5 5 2)	1,784 kWh (£7 8 8)	1,746 kWh (£7 5 6)	1,760 kWh (£7 6 8)
Fires, &c., 1d. per kWh	44 kWh (3s. 8d.)	598 kWh (£2 9 10)	532 kWh (£2 4 4)	410 kWh (£1 14 2)
Tubular heaters 1d. per kWh	19 kWh (15s. 10d)	3,778 kWh (£15 14 10)	*240 kWh (£1)	*4,460 kWh (£18 11 8)
Water heating, ½d. per kWh	2,172 kWh (£4 10 6)	3,290 kWh (£6 17 1)	3,830 kWh (£7 19 7)	4,104 kWh (£8 11)
Total ...	3,778 kWh (£15 16 5)	9,680 kWh (£36 16 8)	6,642 kWh (£23 19 8)	10,888 kWh (£39 1 3)

*The discrepancy is believed to be due to an incorrect meter reading at the end of the March quarter, the totals for the March and June quarters being correct, but the individual readings approximately reversed.

The entire installation was designed and carried out by Messrs. Drake & Gorham, Ltd., to whom we are indebted for the assistance they have given us in the compilation of this article.

" Our Service."

A pocket book under the above title has been issued by the Shropshire, Worcestershire and Staffordshire Electric Power Co., to each of its employés. It sets out in a simple manner all the information relating to the company's activities of concern to the consumer or prospective consumer—showrooms, tariffs, hire facilities, and so on—in addition to much information of a more general character, such as the various applications and uses of electricity, as well as the uses of electrical appliances. The main object of the booklet is to enable the employés to answer questions concerning electricity supply put to them by the public, and is explained adequately in a foreword by Mr. J. T. H. Legge, managing director of the company.

Parliamentary News.

[By our Special Parliamentary Reporter.]

Telephoning to South America.

On December 15th, MR. LEES-SMITH, the Postmaster-General, informed Mr. Matters that a direct radio-telephone service between London and Buenos Aires was opened on December 12th. That service afforded communication between Great Britain and all parts of Argentina, and also, by means of land-line connections from Buenos Aires, to the more important cities in Uruguay and Chile. The charge for a call from London to Buenos Aires was £2 a minute, minimum £6, the same as for a call to New York or to Sydney. Additional charges were made for calls to the more distant parts of Argentina, or to Uruguay or Chile. The service was at present available daily between the hours of 1.30 p.m. and 10 p.m.

Telephone Installations.

On December 16th MR. VIANT, the Assistant Postmaster-General, informed Sir N. Grattan-Doyle that at the end of November, the last date for which figures were available, the total number of outstanding orders for telephones, including those in which the subscriber was not ready for the installation to proceed, was 8,909. The great majority of these were in actual course of completion. Except in a comparatively small number of cases where negotiations for the grant of wayleaves were proceeding, or where completion was awaited of works in hand for the provision of additional underground plant, orders for telephone service were being met without delay.

Electricity and Unemployment.

On December 16th, during a debate on unemployment, MR. MORRISON, the Minister of Transport, referred to the work of electrical development. He said that the Central Electricity Board was proceeding rapidly with the construction of the national Grid. Six hundred local authorities and temporary undertakings were being encouraged to go forward with various schemes. They were assisting the frequency-standardisation scheme in the North-East Coast area. Eight schemes prepared by the Electricity Commissioners and adopted by the Central Electricity Board under the Act of 1926 now provide for the whole of England and Wales and Central Scotland. The schemes covered 63,000 square miles, which was 72 per cent. of the total territory, and a population of 41.2 millions, equal to over 97 per cent. of the entire population. Up to the end of 1929 the Central Board had placed contracts valued at £12,000,000; during 1930 it placed contracts to the extent of £7,500,000 in respect of the Grid and £3,500,000 for standardisation, making £11,000,000 for 1930 and a total of £23,000,000. To-day there were over 400 miles of main transmission lines in operation; a further 500 miles had been constructed or were under construction, and further sections would be brought into operation at an early date. It was, perhaps, a misfortune that electricity supply had grown up on the basis of local geographical areas so far as distribution was concerned. The former Lord Privy Seal and himself met the representatives of the supply undertakings soon after the Government came into office, and urged on them that the industry was so prosperous that it was legitimate to anticipate the future demands of the consumer. He was glad to say that some response was secured. They followed that up by a circular sent out to each undertaking by the Electricity Commissioners asking them to go forward with the laying of mains for the improvement of the efficiency of their undertakings and to provide employment. In order that that effort should be followed up, he had arranged a conference with the various electricity supply undertakings to discuss with them the ways in which they could hasten still more the development of electricity supply. They were particularly keen that the supply undertakings should pursue a progressive policy. Local supply undertakings varied enormously. Some company undertakings were progressive; others were the reverse. Municipal undertakings, on the whole, were progressive, but there were some of them which were not as progressive as they might be. If they were to make electricity universally available, supply undertakings must adopt schemes of assisted wiring, hire and hire-purchase of equipment, and popular tariffs, which would encourage the use of electricity for all classes of domestic supply. The Electricity Commissioners had appointed two committees to deal with these subjects, and their reports had been circulated to the whole of the industry. It could now be said that generation and main transmission were under substantial national control. The same could not be said of the 600 supply undertakings, which were under local control, and all the Ministry could do with them under existing legislation was to encourage them to go forward in every possible way.

" Pylons " on Ashtead Common.

On December 17th COMMANDER SOUTHBY asked the Minister of Transport whether his attention had been called to the intention of the Central Electricity Board to erect pylons to carry an electric line across Ashtead Common, and whether, in view of the fact that the common was a recreation ground within the meaning of the Act of 1919, and that the distance involved was only about 400 yards, he would approach the Central Electricity Board with a view to having the line laid underground.

MR. MORRISON said that his attention had been called to this matter. The question whether any land was a pleasure ground within the meaning of Section 22 of the Act of 1919 would only come within his purview in the event of an application being made for his consent to a compulsory wayleave, and in the circumstances he was not in a position to intervene.

A.C. Commutator Motors.

Their performance compared with that of slip-ring motors, especially when variable speed is required.

(*Report of an informal discussion by the* LONDON STUDENTS' SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE full title of the discussion was " Commutator *versus* Slip-ring Motors," but Mr. L. J. Hunt, who occupied the chair, deprecated—rightly, we think—the use of such a title, on the ground that each type had a field of its own, apart from the overlapping territory.

Mr. F. W. Read opened the discussion in the place of Mr. E. J. Loveridge, who had been called away on business. He claimed that for single-phase work the a.c. commutator motor stood alone, and in view of the changes taking place from d.c. to a.c., where the d.c. mains would be operated on the single-phase system, its field was immense. Its starting torque (for 2 to 1 speed variation), equal to full-load torque with 1¼ full-load current, compared with 30 per cent. of full-load torque with 1¼ full-load current for the wound-rotor type. At least one undertaking was satisfied only with the commutator motor. For three-phase work where variation in speed was required, resistance absorption was most inefficient. Even if its efficiency under normal load were slightly more than that of the Schrage motor (which was built in sizes up to 590 h.p.), this, he claimed, was more than counterbalanced by the high power factor of the latter (95 per cent.), which had also a true shunt characteristic. The speed range, controlled by a simple brush-shifting chain and sprocket, was normally in the ratio of three to one, and up to five to one in special cases; within these limits it lent itself to closer regulation than even the Ward-Leonard system, and was, of course, less expensive and more efficient. Taking into account the cost of control gear, the commutator motor would be found not very much more expensive than the slip-ring motor far variable-speed work, while improvement in output, due to its steady speed, and its high power factor would justify its installation where variable speed was not a factor.

Mr. Richardson advanced the claims of slip-ring and squirrel-cage motors with variable-speed gear. He described an interesting system of friction drive that was a little difficult to follow in detail; an essential feature was the use of a special lubricant that caused a film of zinc to form between the rollers and the rims of the gearing. The first cost of a slip-ring motor was, he said, only about two-thrids of that of the Schrage motor. Moreover, in most cases speed-variation was required for short periods only, and the lower efficiency of the commutator motor would be prejudicial to its use.

On the conclusion of the set openings the discussion became general. The following members took part:—**Messrs. Martin, Stevens, Squire, T. H. Lockett, E. J. Satterfield, Tozer, L. S. Crutch, Cordingly, and Heath.**

Mr. L. J. Hunt judicially summed up the situation. He admitted without qualification the merits of the commutator motor for single-phase work, and also a strong case for three-phase work in such applications as printing and lifts. He thought, however, that a case had not been made out for its use for such drives as for colliery fans, where a 2/3 speed was required for week ends: a change-pole or cascade motor would be better. He suggested that the good power factor of the commutator motor would favour its use on systems changing over to a higher frequency in view of the risk of a poor system power factor resulting. In that case the static condenser might prove a strong rival, which would not shut down the plant in the event of its breakdown. When undertakings quoted a tariff with adjustment for power factor, considerable savings might accrue in either case. In some instances it might be economical to use a standard motor designed to run at two or more speeds with resistance control for intermediate speeds; the efficiency curve would have a saw toothed appearance, and the average efficiency might be quite high. Summarising, Mr. Hunt said that in all cases where infinite speed variations were required, or where the proper variation could not be obtained by pole-changing, he would advocate the commutator motor, but, where two or three fixed speeds only were necessary, he considered the slip-ring motor the more satisfactory.

Mr. W. F. S. Walton moved the vote of thanks to the two principal speakers and to the chairman.

D

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

Electrical Distribution Plant Required for Egypt.

The Commercial Secretary to the Residency, Egypt, reports that the Minister of the Interior is calling for tenders for the supply, delivery, and erection of a distribution network for the town of Abou-Tig in the Assiout Province. The specification covers the supply and installation of an underground 6,800-V system, the supply and installation of an overhead network with steel tubular poles and bare copper cable, and the supply and installation and wiring up of lamp standards, electric clocks, &c. Tenders will be received up to February 21st. A copy of the specification and general conditions of tender, together with blue prints is available for loan in order of application from the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1. Local representation is essential. The Department is prepared to furnish United Kingdom firms desirous of tendering for the supply of material of United Kingdom manufacture and not represented in Egypt with the names of British merchant houses with Egyptian connections who may be willing to handle tenders on their behalf.

Rectifier Manufacturer in Australia.

The Melbourne *Age* reports that Mr. A. H. Bagnall, engineer and technical and commercial representative of the Hewittic and Hackbridge electrical companies, arrived in Melbourne in October. Mr. Bagnall stated that the managing director of the companies, Mr. W. W. Hughes, would arrive there in December with the object of arranging for the manufacture in Australia of electrical rectifiers, which were now largely in use in wireless sets. He himself was to supervise the installation of a 500-kW traction equipment, imported by the Melbourne Electric Supply Co., Ltd.

Great Britain's Radio Exports.

The *Wireless and Gramophone Trader* has published statistics of exports of radio apparatus during the third quarter of the year. The total value was £253,430, as compared with £243,592 in July-September, 1929. Australia was again the principal market with a share valued at £32,395, against £37,202. The second place was again held by the Netherlands with £21,929 against £21,919. Other important customers were South Africa £21,278 (£11,657), France £19,597 (£9,140), the Irish Free State £12,044 (£9,643), Italy £11,142 (£6,548), and Czecho-Slovakia £10,627 (£2,228). Of the re-exports of imported goods valued at £62,734 (against £16,814), the Netherlands was responsible for £47,849 (against £3,320).

The Birmingham Electric Club.

The report for the past year, which was presented at the annual meeting on December 19th, showed further progress: the total membership is now 277. Reference was made to the election of Mr. R. A. Chattock as hon. life vice-president of the Club, and particulars were given of the lectures delivered before the Club during the year. The accounts disclosed a satisfactory financial position.

Unemployment.

There were 1,323 more persons on the registers of Employment Exchanges on December 8th than a week before. The total number on December 8th was 2,306,962, as compared with 2,305,639 on December 1st, and 1,309,504 on December 9th, 1929.

The Rumanian Telephone Service.

An agreement has been entered into between the Government of Rumania and the International Telephone and Telegraph Co., of New York, by which the company will take over the working of the entire telephone service in Rumania on January 1st, 1931. The Rumanian subsidiary of the American company, which has been formed to re-arrange and complement the existing network, has already prepared a five-year extension programme and will shortly establish a telephone factory in Rumania. Rumania will be connected with the European network by means of long-distance underground telephone cables.

New Polish Cable Works.

It is announced that the Polish Cable and Copper Rolling Works, of Warsaw, will bring into operation next April a new cable factory which has been established at Ozarow, near Warsaw. The company is said to be in financial connection with the Swiss Elwerta financing company, of Glarus (the Felten and Guilleaume group), and to work under licences from the latter company, the Siemens Company and the A.E.G.

Germany's Foreign Electrical Trade.

The official returns lately to hand show that the imports of electrical machinery and apparatus into Germany during the ten months ended with October last attained a value of £1,751,700, as compared with £2,117,400 in the corresponding period of 1929. The exports of similar material from Germany during the period under review increased from £23,761,000 to £23,778,900. The import total was made up of electrical machinery valued at £339,150, and parts, apparatus and fittings to the extent of £1,352,550. The respective figures for the exports were £4,646,250 and £19,132,650.

Tungsram in Ireland.

In our last issue (p. 1055) we recorded the registration, in Dublin, of Tungsram Lamps & Radio, Ltd. We are now informed that the company has acquired premises at 11, Burgh Quay, Dublin, and branches in other parts of Ireland are contemplated. Mr. R. G. W. Mucke will be in charge of the company as manager and director.

Southern Railway Contract for Sweden.

According to the *Morning Post*, the Southern Railway Co. has decided to place a contract for switchgear in connection with the London-Brighton electrification, valued at £65,000, with a Swedish company. The railway company is reported to have taken this decision on account of the great discrepancy between British and Swedish quotations.

Export Trade Development.

We are informed that an Export Trade Development Board is to be inaugurated at a meeting early in the New Year. This will be a non-political body aiming at stimulating British export trade by all possible means. Its methods of procedure may be judged from the following resolution which is to be put before the meeting: "To urge the development of British export trade by close co-operation with the Government Departments directly concerned, and more especially the Department of Overseas Trade; to urge upon His Majesty's Government the creation of a first-class Ministry of External Commerce to supersede the present Department of Overseas Trade, the Minister to have a seat in the Cabinet; to encourage the enrolment of commercially-trained men into the Government trade intelligence services; to foster British export trade by encouraging the publication of trade publications to be circulated overseas; to maintain a Trade Information Bureau for the use of visiting foreigners in a prominent position in London; and generally to promote and use every effort to encourage British manufacturers in their endeavours to regain overseas markets."

Further information regarding the subject may be obtained on application to the Acting Secretary of the Export Trade Development Board, Oxford House, 83/91, Great Tichfield Street, W.1.

A German Merger.

The Berlin correspondent of the *Financial News* reports that merger arrangements were completed on December 17th between the locomotive factories of the A.E.G. and Borsig. The scheme provides for the establishment of a common operating factory under the name of Borsig Lokomotivwerke, G.m.b.H., in Berlin. The A.E.G. will participate in the merger to the extent of 60 per cent., and Borsig with 40 per cent.

Employment during November.

The December *Ministry of Labour Gazette* states that employment in the engineering industry remained bad in November and showed a general decline. In the electrical engineering section, employment, though very moderate and declining, was better than in other sections. The total number of persons unemployed in the engineering industry was 204,631, or 20.1 per cent. of the total, as compared with 19.4 per cent. in October. The figure for electrical engineering was 10,232, or 11.4 per cent., against 10.1 per cent. The electric cable, wire, and lamp manufacturing group reported a total of 10,225 unemployed, representing 10.0 per cent., against 9.7 per cent. There was increased unemployment in the electrical wiring and contracting industry, the number being 2,025 (10.9 against 9.9 per cent.).

A Mission to Egypt.

Upon the recommendation of the Overseas Trade Development Council, Mr. G. M. Gillett, the Parliamentary Secretary to the D.O.T., has appointed a Trade Mission which is to proceed to Egypt early next year "to inquire into the present position of trade between the United Kingdom and Egypt and to report what action should be taken to develop and increase that trade." The chairman of the Mission is Sir Arthur Balfour, Bt., who was chairman of the Government Committee on Industry and Trade appointed in 1924. The other members are Sir Alan G. Anderson, K.B.E., a director of shipping and railway companies; Mr. W. R. Blair, Co-operative Wholesale Society; and Mr. Kenneth Lee (textiles). Messrs. T. L. Relton and W. G. Bruzaud, of the Department of Overseas Trade, have been appointed secretary and assistant secretary, respectively. It is anticipated that the Mission will leave for Egypt in February.

Imperial Chemical Industries.

It is interesting to know that in connection with the description which we have just published of the immense works of Synthetic Ammonia & Nitrates, Ltd., at Billingham, the electrical staff, jointly with all directors involved, have celebrated the completion of their three-year construction programme by a dinner at which some of the directors of Imperial Chemical Industries, Ltd., were present. All the large firms who carried out the main portions of the electrical work were represented and a very enjoyable evening was spent.

E.D.A. Activities.

The accompanying illustration shows the suggested window display included in the E.D.A. January programme. This window is the first of a series which will be linked up closely with the second section of the Eda Electric Homes Campaign, the sub-title for which will be "Three Plug Points"; this will also be the title of the Campaign publicity booklet which will take the place of "The House You Want" issued last year.

We have received some notes on the progress of the 1930 Shop and Display Lighting Canipaign, a complete report on which is to be prepared early in the new year. From these we gather that the objective of the Campaign—that of increased business to the electrical industry—has been successful beyond anticipation. Excellent results have been reported and are still being received from all over the country. The comprehensive tour of the Sign Van has proved successful, in spite of weather difficulties in certain towns, and considerable orders are reported.

The Shop Lighting Competition in Leeds was held on November 28th, the Campaign trophy being awarded to Messrs. Austin Reed, Ltd., a night view of whose premises is shown in the illustration in the right-hand column.

The E.D.A. January Window Display.

Lamp Manufacture in Poland.

It is stated that the Philips Glow Lamp Works has established a lamp factory in Warsaw under the title of the Polish Philips Works with a productive capacity of 8,000,000 lamps per annum, equal, it is said, to the present total lamp consumption in Poland.

The Place of the Wholesaler.

In a recent address to the members of the National Electrical Wholesalers' Association, United States, Mr. B. W. Clark, chairman of the Association, spoke of the position of the wholesaler, and particularly the electrical wholesaler, in the distribution of manufactured goods. He expressed the opinion that the wholesale house, with its functions of grouping and storing the products of a large number of manufacturers, and the efficient distribution of these products, could serve the public at a lower cost than could any individual manufacturer. He also claimed that the average gross profit of the American wholesaler had fallen from 22 per cent. to 16 per cent., while his operating cost had declined from 17 to 14 per cent. Mr. Clark also made reference to the "small order menace." It cost $3.75 to handle an average order and it was impossible to handle any open account order for less than $3. When small orders represented the incidental needs of a good customer, it was essential to deal with them, but when they came from a casual source and in large numbers the business was unremunerative. He did not think that "national" wholesalers, in spite of their advantages, could be successful. The business was localised and intimate and in this lay its greatest strength. The speaker thought that so long as a large amount of money was available for the making of electrical products the wholesaler would find manufacturers to whom he could sell his services as distributor. Very few manufacturers could do their own distributing successfully.

Austin Reed's Leeds Display.

The Co-ordination of London Transport.

The Special Committee on Traffic appointed by the London County Council, after considering the proposals of the Minister of Transport to establish a Transport Board for the London Traffic Area, recommended the Council to adopt the following resolutions regarding the Bill: (i) That the proposals of the Government to vest large powers of ultimate control of policy of the transport services of the London Traffic Area in the hands of a Minister of State, and to exclude municipal representatives except in an advisory capacity, are contrary to sound principles of local government; (ii) That it is desirable that the management, as distinct from the determination of large policy, should be vested in a small number of persons of business and other qualifications to be defined by statute; (iii) That there should be a statutory obligation that the combined undertakings should be so conducted as to meet all proper charges from revenue; (iv) That the basis of acquisition of local authorities' undertakings should be not less favourable than that applied to privately-owned undertakings; and (v) That the proposed basis of acquisition of the Council's tramway undertaking is inequitable and contrary to the interests of the Council and the ratepayers of the County of London. The recommendations were adopted by the L.C.C. at last week's meeting.

The American General Electric's Unemployment Relief Scheme.

Mr. Gerard Swope, president of the American General Electric Co., recently announced that every employé of the company, "from president to office boy," who is working 50 per cent. or more of full time will contribute one per cent of his December wages to the company's new unemployment fund. The company will contribute an equal amount to the fund. The *Electrical World* says that under the rules of the unemployment plan, as originally announced, payments were not to be made for at least six months after its inauguration, which would not have been until January or February, but because of the unemployment emergency it was decided to start relief this month but to limit payments to a maximum of $15 per week to employés needing assistance. It has also been decided to consider for assistance employés who may not have contributed to the plan but are in need of help. Approximately 35,000 employés have been contributing to the plan and by December 1st they had paid in $350,000.

American Electrical Expansion to Continue.

The *Electrical World* reports that in spite of the business depression in the United States, the 1931 construction budgets of the leading utilities indicate that there will be no interruption of the companies' expansion. The Southern California Edison Co. proposes to spend $28,000,000 on extensions of its system during next year. This is said to be the largest annual expenditure ever made by the company which anticipates an addition of 350,000 h.p. to its connected load. Our contemporary quotes several other examples of increased construction budgets prepared by leading utility companies.

Irish Free State Electrical Imports.

The imports of electrical machinery, apparatus, and cognate goods into the Irish Free State during October were valued at £85,379, as compared with £87,682 in October, 1929. The subjoined table gives the imports during the first ten months of the two years.

	January to October. 1929. £	1930. £
Electrical machinery	271,035	253,262
Electric wires and cables	171,148	138,539
Electric lamps and parts	64,551	75,051
Radio sets and parts	64,230	76,907
Other electrical goods	212,993	173,805
Copper wire	78,011	39,677
Totals	£861,968	£757,061

It will be seen that so far this year there has been a decline of £104,907 in the gross imports, the only items showing an increase being electric lamps and radio apparatus.

Local Exhibition.

CARLISLE.—An electrical exhibition was held in the Infantry Drill Hall, Carlisle, from December 6th to 13th, under the auspices of the Carlisle Circle of the British Electrical Development Association. The exhibition was formally opened by the Mayor, supported by Mr. W. F. T. Pinkney, chairman of the Northern Area E.D.A. Committee, Mr. C. W. Salt (city electrical engineer), and Mr. H. P. Baynham (deputy electrical engineer), members of the Carlisle Committee. The exhibition proved successful and created a number of useful inquiries. It was opportune inasmuch as it coincides with the anticipated extension of the Carlisle electricity supply to outlying rural districts. The exhibitors included the following:—Siemens Electric Lamps & Supplies, Ltd.; Sadia, Ltd.; Belling & Co.; Ferranti, Ltd.; Edison Swan Electric Co., Ltd.; Berry's Electric (1928), Ltd.; Revo Electric Co., Ltd.; Korting and Mathiesen Electrical, Ltd.; Kelvinator, Ltd.; General Electric Co., Ltd.; Philips Lamps, Ltd.; R. A. Lister & Co., Ltd.; Curfew Electric Heaters; Electric Lamp Manufacturers' Association of Great Britain, Ltd.; Macintosh Cable Co., Ltd.; British Insulated Cables, Ltd.; J. H. Tucker & Co., Ltd.; and the Hotpoint Electric Appliance Co., Ltd. A general view of the exhibition is shown in the accompanying illustration.

Carlisle Electrical Exhibition.

A Church-lighting Installation.

The accompanying illustration shows a good example of church lighting, installed at All Saints' Church, Friern Barnet. The installation has been carried out by the North Metropolitan Electric Power Supply Co., employing Siemens Holophane floodlight units with Siemens electric lamps, mounted in the roof of the church so that the whole of the light is directed downwards and forwards, the fittings being well out of the line of vision. Trough reflectors are installed behind the chancel arch, fitted with Siemens opal lamps and these give light for the choir and strengthen the lighting at the east end of the church. The new lighting brings out the beautiful decoration and architectural features of the church.

Lighting of All Saints' Church, Friern Barnet.

German Plant for Russia.

The Siemens-Schuckertwerke, of Berlin, has recently secured a contract from the Soviet Government authorities for the supply of two 50,000-kW steam turbines for the extension of the Kaschira station of the Moscow electricity undertaking. The turbines are to be of the Roder type designed to run at 1,500 r.p.m. and to use steam at a pressure of 25 atmospheres and a temperature of 385 deg. C.

Bombay Contractors to Boycott British Goods.

We learn on good authority that the Bombay Electrical Contractors' Association has passed a resolution prohibiting its members from buying, stocking, dealing in, or using any electrical goods of British origin.

Overseas Trade and Salesmanship.

Presiding at the annual dinner of the Incorporated Sales Managers' Association on December 16th, Sir Francis W. Goodenough proposed the health of the Prince of Wales, the principal guest. In the course of his speech he mentioned that the final report of the Committee on Education for Salesmanship, of which he is chairman, would be issued early in the New Year. This would deal with the place of the schools and universities in education for commerce as a career; with the selection of recruits for commerce; the subject of further education for entrants into commerce; and the problem of training the individual salesman to sell products to individual customers.

In the course of a long reply, the Prince of Wales said that we all had to realise that the markets of to-day were not those of Victorian or Edwardian days. Other countries made more and more of the articles which we used to sell them and business could only be obtained and retained by skilful selling campaigns, energetically pursued and adequately financed. The best brains should not be confined solely to production; a goodly share of them must be concentrated on the difficult, complex, but interesting, job of meeting competition in world markets. One of the leading requisites was a thorough knowledge of the markets in which business was sought; an intimate acquaintance with the language and the methods of living was essential. Only specialised education could produce the desired type of man, but the training should not involve the loss of general culture. He was confident that if British commercial leaders were fully awake to the position, they could with the help of the schools and the fine human material available, restore British trade to its legitimate position in the markets of the world and maintain it in that position.

Trade Announcements.

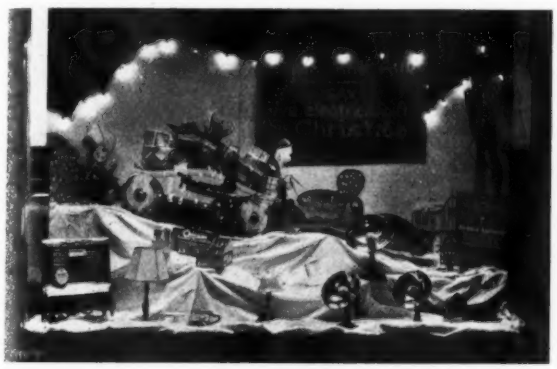
The RUNBAKEN MAGNETO CO., LTD., Ardwick, Manchester, states that its London Agents, Messrs. S. W. Lewis & Co., Ltd., 39, Victoria Street, S.W.1, who have been acting as the company's distributors in the south for some time, have now taken over the sole distributing rights for Great Britain for Runbaken products. A service depôt has been opened at 11, Keswick Road, Putney, to deal with repairs and adjustments to the company's various accessories.

The POWER PLANT CO., LTD., West Drayton, Middlesex, has appointed Mr. G. H. Harrison, "Hazlemere," Knoll Avenue, Swansea, as its agent for the South Wales district.

MR. FRED DAWSON, wholesale electrical and radio distributor, has removed to larger and more central premises at 9, Mill Hill, Leeds.

The G.E.C. Christmas Display.

The accompanying illustration shows a Christmas display in one of the show windows of the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C. As will be seen, the display has a winter setting showing a wagon loaded with parcels



A "Magnet" Christmas Display.

containing "Magnet" electrical gifts, drawn by animals, or insects, of doubtful species, and presumably manned by "Magnet Folk." The electrical gift idea is emphasised by a well-assorted display of domestic appliances in the foreground.

Book Notices.

"The *Practical Engineer* Electrical Pocket Book and Diary." Pp. cx+597; illustrated. London: Oxford University Press. Price: 2s. 6d. cloth, 3s. pluviusine. In the 32nd edition the usual yearly revision has been carried out and much useful information is included as to the advances that are now being made in many branches of the electrical industry. New matter has been added describing some modern methods of remote control by electrical valves, such as those used in large water circulating systems and for the regulation of exhaust steam, and some recent changes in construction of plates of standard types of secondary batteries are described.

"The *Mechanical World* Year Book, 1931." Pp. clxxvi+358; fully illustrated. Manchester: Emmott & Co., Ltd. Price 1s. 6d. net. A careful revision has been made of the contents of this valuable publication and several improvements have been made. New sections have been introduced and those relating to steam boilers, internal-combustion engines, hydraulics, and gearing have been rewritten and enlarged.

"Experimental Electricity," by R. H. Walters. Pp. viii+145; illustrated. London: McGraw-Hill Publishing Co., Ltd. Price 7s. 6d. net.

"Radiations from Radio-active Substances," by Sir Ernest Rutherford, J. Chadwick, and C. D. Ellis. Pp. xi+588; figs. 140. London: Cambridge University Press. Price 25s. net.

We have received from Messrs. Holophane, Ltd., an interesting 64-page booklet on scientific industrial illumination. A quantity of practical information is given, with detailed descriptions and illustrations of units suitable for the many and varied industries.

"Electric Circuit Analysis," by Michel G. Malti. Pp. vii+389; illustrations and tables. London: Chapman & Hall. Price 22s. 6d. net.

Calendars and Diaries.

The 1931 calendar of Mr. W. H. SQUIRE, 31, Sweyne Avenue, Southend-on-Sea, bears a picture of a gipsy girl with the title "Sometimes Dreams Come True."

A view, in colour, of St. Giles's Church, Stoke Poges, graces the first sheet of the 1931 calendar sent out by CALLENDER'S CABLE & CONSTRUCTION CO., LTD. The other sheets (one for two months) bear illustrations typifying various phases of the company's activities.

Messrs. W. G. BEAUMONT & SON, Bow, E.3, have again sent us their year book for the ensuing twelve months. This is a desk diary of a handy size, with blotting paper interleaved between the weekly pages.

We have received from MR. FERNAND ESPIR, 86, Queen Victoria Street, E.C.4, a refill for the calendar of the Tréfileries et Laminoirs de Hâvre.

The monthly sheets of the 1931 calendar of LIGHTALLOYS, LTD., Willesden Junction, N.W.10, have an appropriate aluminium finish. Each sheet bears a picture of some application of "Alpax" alloy.

Pads of boldly-figured daily slips mounted on simple cards form the 1931 calendars of Messrs. LINDSAY & WILLIAMS, LTD., Manchester, and Messrs. J. SHAW, SON & GREENHALGH, LTD., Huddersfield.

In accordance with the usual custom the calendar of the LIVERPOOL ELECTRIC CABLE CO., LTD., is illustrated by a "Mersey" subject. This year the steamers *Royal Iris* and *Royal Daffodil* are pictured.

The monthly sheets of the calendar of BRITISH JEFFREY-DIAMOND, LTD., Wakefield, show examples of the company's coal-cutters, conveyors and other products.

The ENFIELD CABLE WORKS, LTD., is issuing a businesslike calendar with large monthly sheets on which the previous and succeeding months are shown.

Examples of the firm's fuse-gear, &c., are illustrated on the 1931 calendar of Messrs. H. J. FULLER & SONS, Leeds. A block of daily slips is provided.

"Dreams" is the title of the picture of a pensive damsel gracing a calendar sent us by Messrs. CHRISTY BROS. & CO., LTD., Chelmsford. It is printed in silk and neat monthly date slips are below it.

A bucking broncho, typifying the "kick" of "Exide" batteries, illustrates the CHLORIDE ELECTRICAL STORAGE CO.'s calendar for 1931.

Social Events.

The annual dinner of the Carlisle Corporation Electricity Department was held in the Silver Grill, Carlisle, on December 12th. Mr. Salt, city electrical engineer, presided over a large company which included the Mayor, Mr. G. Middleton, M.P., and Mr. H. P. Baynham (deputy city electrical engineer). Mr. Middleton, who proposed the toast of "The Mayor and Corporation of the City of Carlisle," said he was happy to know that their own particular undertaking had been regarded as sufficiently successful to attract the attention of the Government and that they were going to have entrusted to their care a large territory. He believed that this was due to the success of their undertaking and it was very largely due, he thought, to the enterprise and the skill of the officers of their Department, particularly Mr. Salt and Mr. Baynham. Mr. Salt, in replying to the toast of "The Chairman," drew attention to the advance of the undertaking during the last few years, and to the recent installation of a 15,000-kW turbo-alternator. In the work of development he said that he wished to acknowledge the invaluable assistance of all the staff and the men employed.

The annual dinner of the G.E.C. Debating Society was held on December 4th at the Mitre Tavern, Chancery Lane, W.C.2, when Mr. W. H. Hickin presided over an assembly of 60, including Mr. H. W. Roberts, as the guest of the evening. The Chairman proposed the toast of "Our Guest," and Mr. Roberts suitably replied. The toast of "The G.E.C. Debating Society" was in the able hands of Mr. Heather, and Mr. F. E. Rowland responded. In a felicitous and witty speech, Mr. E. A. Joyce paid homage to "The Ladies," and an apt reply was made by Miss Gregory. The evening was interspersed with musical items.

On December 16th the Staff Sports Club of the Leatherhead and District Electricity Co., Ltd., held its second social and dance of the season, at the New Bull Hotel Restaurant. The evening proved a great success and the programme of dances carried out under the direction of Mr. F. W. Ferrari was thoroughly enjoyed. Owing to the indisposition of Mr. G. W. F. Horner, Mr. W. E. Owen kindly presented the prizes for the various dances, &c. The O.S.A. Band supplied the music.

New Catalogues and Lists.

STURTEVANT ENGINEERING CO., LTD., 147, Queen Victoria Street, London, E.C.4.—Publication No. 1,371, giving particulars, with excellent illustrations, of the "Sturtevant" air washers, air filters, and conditioning apparatus.

CROMPTON PARKINSON, LTD., Guiseley, Leeds.—A leaflet entitled "Speed," referring to the company's "service," and a card announcing the cancellation of the 1929 abridged price list.

JOHN DUGDILL & CO., LTD., Hazel Grove, near Stockport.—An abridged list of movable, focusing, self-sustaining fittings for all purposes.

SIGMA ELECTRICAL MANUFACTURING CO., LTD., Sigma Works, Browning Street, Ladywood, Birmingham.—An illustrated and priced catalogue of "Sigma" water-tight fittings, conduit fittings and street lighting equipment.

The MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, London, W.1.—A supplement to the recently-issued Marconi valve catalogue, containing full details of a new series of 2-volt valves.

"BEEANTEE" ILLUMINATIONS, LTD., 70, Banner Street, Bunhill Row, London, E.C.1.—A leaflet describing the "Beeantee" lighting strip holder and an illustration of the "Beeantee" installation at the Roker lighthouse.

HAILWOOD & ACKROYD, LTD., Morley, near Leeds.—An illustrated and priced list of "Hailware" lighting fittings, showing, partly in colour, a large range of plain and decorative shades, globes and bowls. Also a reprint from the *Morley Observer*, entitled, "A Dozen Trades under one Morley Roof."

CALLENDER'S CABLE & CONSTRUCTION CO., LTD., Hamilton House, London, E.C.4.—Illustrated booklets dealing with the "Maranex" ship wiring system and the "Callender" overhead distribution and service system.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—A booklet entitled "British Industry Across the Seven Seas," which gives an interesting insight into the company's methods of working and a view of the extent of "B.I." activities throughout the world.

X-RAYS, LTD., 47, Red Lion Street, London, W.C.1.—A supplementary list of the products of the company.

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, London, E.C.1.—Folder No. 331 describing improved boxes and other accessories for Henley's wiring systems.

For Sale.

Manchester Corporation Electricity Committee has for disposal a large number of second-hand d.c. motors and miscellaneous double-pole switches and fuses.

Several used d.c. motors, with starters and pulleys, are offered for sale by Aylesbury Electricity Department.

(See our advertisement pages to-day.)

Bankruptcy Proceedings.

J. W. WHITE, radio and electrical engineer, 32, Castledere Road, Parkstone, Dorset.—The public examination of this debtor was held recently at the Law Courts, Bournemouth, when a statement of affairs was submitted which disclosed liabilities of £1,353, and assets estimated to realise £239, leaving a deficiency of £1,114. The debtor said he commenced business on his own account in February, 1928. He traded as "The House Repair Service Co.," and had no capital. He obtained an overdraft from the bank of £200, which was guaranteed by another. A profit and loss account prepared for the period to June 24th, 1929, showed a net profit of £1,078, and the debtor's drawings were £366. Later, the business was removed to larger premises and a private company was incorporated in August, 1929, called "The House Repair Service Co., Ltd.," to take over the debtor's business as from June 24th, 1929. The nominal capital of the company was £4,000. The consideration for the sale to the company was £1,000 to be satisfied by 700 fully paid ordinary shares and £300 in cash. The debtor was to discharge the liabilities, about £550, and receive the book debts, approximately £200, existing at June 24th, 1929. The debtor received £5 weekly whilst acting as managing director of this concern. Some difficulty was experienced in carrying on the business owing to very little money being subscribed, and to provide working capital the company obtained an overdraft of £400 from the bank. The position of the company did not improve, and on February 14th, 1930, it went into voluntary liquidation. Answering questions, the debtor said that he received the 700 ordinary shares mentioned above, but he did not get the £300 cash. The company had been formed for the purpose of obtaining more capital, but promises of financial assistance had not materialised. The debtor had put all he possessed into the company, as he understood the money was to be forthcoming, and he would receive £300. The company's assets had been realised; the debtor had purchased £100 worth of them, and had given a charge on any dividends that might come to him from the assets of the company. After the liquidation he had tried to earn a living as an electrical and radio engineer. This was unsuccessful and a meeting of his creditors was held, at which an offer was made to pay £2 a week for distribution to the creditors. He attributed his failure to "not receiving the consideration price for the business, and not being paid all the promised capital for the company." The examination was closed.

V. R. SHEWAN and A. L. GRACE, trading as the Avon Radio Manufacturing Co., wireless manufacturers, Long Ashton, Somerset.—The public examination of these debtors was held recently at the Guildhall, Bristol, when a joint statement of affairs was submitted which disclosed a deficiency of £479. The debtor V. R. Shewan stated in reply to questions, that he had commenced business with his partner in 1927, at Long Ashton. They traded as radio engineers and manufacturers. The business was fairly successful for the first year, but during the next year trade was not so flourishing. The profits from the business were never sufficient to meet their drawings for living expenses. The failure was attributed to "bad trade, liability to pay £84 on account of excess royalties on wireless sets, want of capital, and bad debts." The examination was closed.

R. PEARSON, trading as R. Pearson & Sons, electrical accessory manufacturer, "Xtra Point" Electrical Works, Walshaw Road, Bury, Lancs.—This debtor again appeared at the Court House, Bolton, recently, for examination. He stated that he commenced business as an electrician in 1922 at Greenmount, Bury, with £50 capital. In June, 1929, he removed to Walshaw Road, for the purpose of selling a wiring invention. At that time his liabilities were about £500. From June, 1929, until the date of the receiving order he had borrowed £4,000, all of which was still owing. His statement of affairs showed ranking liabilities of £5,248, and assets of £4,875, leaving a deficiency of £374. He had drawn £8 a week from the business, and his three sons had drawn £3 5s. He had lost £50 through betting during two years. The examination was closed.

The MARQUESS OF WINCHESTER, company director, 1, Portland Place, W.1.—The receiving order in this matter was made on November 6th and the debtor's public examination was to have been held before Mr. Registrar Mellor on December 16th. It was stated, however, that the trustees of the Official Receiver had not yet completed their investigations and the debtor had been given leave to go abroad in connection with business affairs. In the circumstances an adjournment was asked for, and by consent it was arranged to adjourn the examination until February 10th. The statement of affairs presented shows total liabilities of £462,182, of which £289,642 is expected to rank for dividend, and assets (absorbed by preferential claims) of £1,025.

W. F. O. SEWELL (Commercial Electrical Co.), electrical engineer, 24, James Street, Bradford.—First meeting held December 23rd at the Official Receiver's office, 12, Duke Street, Bradford. Public examination January 30th at the County Court, Manor Row, Bradford.

Company Liquidations.

GORING & STREATLEY ELECTRIC LIGHT & POWER CO., LTD.—A meeting of members is to be held at Broad Sanctuary Chambers, Westminster, S.W., on January 19th, to receive an account of the winding-up of the company by the liquidator, Mr. H. Fraser.

KNIGHTON ELECTRIC SUPPLY CO., LTD.—A meeting of members is to be held on January 30th at the Council offices, Knighton, Radnorshire, to receive an account of the winding-up of the company by the liquidators, Mr. W. Lloyd and Mr. P. Parker.

Meeting of Creditors.

DIRECTOPHONE, LTD.—A meeting of creditors is to be held on January 5th at 31, Bedford Row, W.C.

The Buenos Aires Exhibition.

In a letter to *The Times*, published on December 18th, Sir Malcolm A. Robertson, former British Ambassador to Argentina, endorsed the appeal of the Prince of Wales to business men to visit South America to acquire a first-hand knowledge of conditions there. He said that much could be hoped from the British Empire Trade Exhibition, but it would be unreasonable to expect miracles. "Everything, to my mind, depends upon the readiness of the leaders of our industries to go out themselves to inquire into Argentine needs, or, at any rate, to send their sales managers to study conditions on the spot and to enter into personal contact with a people who are, I know, only too anxious to buy from us who buy so largely from them."

In the same issue Mr. Follett Holt, chairman of the London Committee of the Exhibition, also reinforced the Prince's appeal. He pointed out that although the Exhibition was being held in Buenos Aires it was not Argentina alone to which it would make its appeal; prominent buyers from Brazil, Chile, Uruguay, Peru, Bolivia and Paraguay would also be there.

The GENERAL ELECTRIC CO., LTD., informs us that its exhibits at Buenos Aires will be divided, broadly, into industrial engineering products on one range of stands and lighting and domestic exhibits on another range. The industrial section will include examples of Witton products, including standard motors, switchgear, transformers, and a traction motor and controller complete, as supplied to the Buenos Aires Central Terminal Railway. There will also be a selection of large cooking equipment; an exhibit of apparatus made by the Siemens and General Electric Railway Signal Co., Ltd.; industrial and wiring accessories; and small industrial equipment. A complete range of "Magnet" domestic heating, cooking and labour saving devices will be shown, as well as a collection of the company's radio apparatus and valves.

Technical Publicity.

In an address before the Bradford Publicity Club last week Mr. F. Rowlinson, of the United Steel Companies, Ltd., dealt with "The Publicity Department in Relation to Marketing the Technical Product." He pointed out that technical marketing was the marketing of technically-produced articles to the technically-minded buyer, as distinct from the marketing of products perhaps involving high technical skill in their production, but sold to the layman. The chief difference lay in the fact that the technical buyer was not influenced by the effects of style, fashion or taste which influenced his buying as a private individual. He usually knew what he wanted better than the manufacturer from whom he was buying, and he tied up his requirements in every kind of watertight specification. The work of a technical publicity department was chiefly educative—not only of the buyer, but also of the internal staff. The technical publicity man's work had its bearing upon every product from the time it reached the estimating department, through every stage of production, to the packing and transport. Technical publicity also concerned itself in disseminating confidential information to salesmen about new or

existing products, and could frequently learn much from the investigation of complaints. It became of vital importance in combating not only the ordinary form of competition (that of manufacturer against manufacturer), but in newer kinds of competition—industry against industry—and (a form which was particularly rife) entrepreneur against basic manufacturer. By suitable publicity methods in his marketing, the manufacturer of basic commodities might keep the control of profitable lines to himself. The speaker ended with a strong assertion that technical publicity was too often allowed to be a thing apart from the rest of the marketing policy, and said that the purpose of his remarks was to bring technical publicity into its proper integral position in a technical marketing scheme.

Lantern Slides.

We learn from the BRITISH JEFFREY-DIAMOND, LTD., Stennard Works, Wakefield, that it has available an up-to-date selection of lantern slides illustrating all the latest developments in electrical machine mining equipment, including coal-cutters, conveyors, switchgear, &c. The company will be pleased to lend these slides to lecturers and teachers and suitable notes will be furnished with them.

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price Dec. 22nd	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5½d.	...
a	Ammoniac, Sal ... ... per ton	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,	£17	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... . per lb.	8d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£18 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3½d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton.	£85 to £90	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metals—		
	Grade I ... ... per ton net.	£10*	£6 dec.
	Grade II ... ... ,, ,,	£78	£8 dec.
	Grade III ... ... ,, ,,	£48	£2 dec.
c	Brass (rolled metal 2" to 12" basis) per lb.	7½d.	½d. dec.
c	,, Tubes (solid drawn) ... ,,	10d. to 10½d.	½d. dec.
c	,, Wire, basis ... ... ,,	8½d.	½d. dec.
c	Copper Tubes (solid drawn) ... ,,	11¼d.	¼d. dec.
g	,, Bars (best selected) ... per ton	£77	...
g	,, Sheet ... ... ,,	£77	£7 dec.
g	,, Rod ... ... ,,	£77	...
d	,, (Electrolytic) Bars ... ,	£86 15s.	...
d	Sheets ...	£143 10s.	...
d	Wire Rods ,,	£66 18s.	...
d	,, ,, H.C. Wire per lb.	8½d.	...
f	Ebonite Rod	2/3 to 2/6	...
f	,, Sheet	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/1	...
h	Gutta-percha, fine	nom.	...
h	India-rubber, Para fine ... ... ,,	6½d.	½d. dec.
i	Iron, Pig (Cleveland No. 3.) ... per ton.	£3/6	...
l	,, Wire, galv. No. 8. P.O. qual. ,,	£20	...
g	Lead, English pig ... ... ,,	£16 10s.	10s. dec.
g	Mercury ... ... per bot.	£22 7s. 6d. to £22 10s.	...
e	Mica (in original cases) small ... per lb.	6d. to 3/-	...
e	, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,	10/- to 20/- & up	...
p	Phosphor Bronze, plain castings ,,	1/1½d.	...
p	,, ,, drawn bars & rods ,,	1/1d.	½d. dec.
p	, ,, rolled strip & sheet ,,	1/1d.	½d. dec.
p	,, ,, wire ... ... ,,	1/1½d.	½d. dec.
o	Platinum ... ... per oz.	£ 15s.	5s. dec.
d	Silicium Bronze Wire ... ... per lb.	9½d.	...
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
g	Tin, Block (English) ... ... per ton	£116 10s. to £116 0s.	£2 10s. inc.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	2/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a	G. Boor & Co.	g	James & Shakespeare.
b	The British Aluminium Co., Ltd.	h	Edward Till & Co.
c	Thos. Bolton & Sons, Ltd.	i	Bolling & Lowe.
d	Frederick Smith & Co.	l	Richard Johnson & Nephew, Ltd.
e	F. Wiggins & Sons.	n	P. Ormiston & Sons.
f	India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	o	Johnson, Matthey & Co., Ltd.
		p	C. Clifford & Son, Ltd.
		r	W. F. Dennis & Co.

Messrs. James Forster & Co., reporting on December 20th, stated that an easier tone was in evidence in the lead market at the beginning of last week, the price touching £14 10s. per ton on Wednesday. From that point, in sympathy with other metals, there was a sharp reaction, the close being steady. Demand remains very quiet with the near approach of the holidays, the advance on Thursday being almost entirely due to the better sentiment of the stock markets of the world. Arrivals this month promise to be on the full side, and as over 21,000 tons were shipped from Australia and Burma during November, there is little likelihood of any shortage next month, but rather the reverse. The future outlook is certainly not too promising, and unless there is a considerable revival of demand with the turn of the year, lower prices will probably be seen.

Lighting and Power Notes.

Aylesbury.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £4,740 for prospective works at Eledow, Longwick, Wotton, Moreton, Bishopstone, and Chinnor, and for a h.p. transmission line from Brill to Doddershall in connection with the rural electricity extension scheme.

Barnard Castle.—OVERHEAD LINES.—The Cleveland and Durham County Electricity Power Company having intimated its intention of supplying electricity to the villages of Gainford, Ingleton, Hilton, Eangton, and Headlam, the Barnard Castle Rural District Council has given provisional consent to the erection of the necessary overhead equipment.

Bath.—SUPPLY TO ODD DOWN.—The City Council has decided to have electricity for lighting installed in the new houses at Odd Down.

Bedford.—LOANS SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of £4,407 for mains and £573 for sub-station equipment.

MAINS EXTENSIONS.—Mains are to be extended at a total estimated cost of £209.

Bo'ness.—LOANS.—The Town Council is applying for sanction to the borrowing of £1,500 for the purchase of a rectifier for the electricity works, £800 for mains and services, and £200 for meters.

Continental.—DENMARK.—According to official statistics, the capacity of generating stations in Denmark amounted to 346,000 h.p. during the fiscal year 1928-29, as compared with only 188,000 h.p. in 1921-22 (the first year for which figures are available). There has been a corresponding increase in the capacity of individual generating sets, the average h.p. per generating set increasing from 186 in 1921-22 to 323 in 1928-29. These figures do not include power plants in private establishments or those in factories. In 1921-22 the production of electricity amounted to 189 million kWh and by 1928-29 this had increased to 331 million kWh. Adding to this figure approximately 170 million kWh from private enterprises, the total production of electricity in Denmark may be taken to amount to about 500 million kWh. About 35 million kWh is also "imported" from Sweden. During the seven years electricity consumed for lighting increased from 55,000,000 to 110,000,000 kWh, the consumption of energy for power purposes rising from 90,000,000 to 164,000,000 kWh. At present the sum invested in electrical power plants amounts to nearly £24,000,000, and the financial results of their operation have proved very satisfactory. Most of the generating stations in the country are municipally owned, though some of them, in the smaller communities, are worked on a co-operative basis. They all use coal for the generation of power and this is imported from England, Germany, and Poland.

GERMANY.—Owing to the industrial depression the output of electrical power at the 122 principal generating stations in Germany has so far this year shown a decrease. The production during September last amounted to 1,311,000,000 kWh, bringing up the total for the first nine months of the year to 11,971,000,000 kWh, as compared with 12,159,700,000 kWh in the corresponding period of 1929.

CZECHO-SLOVAKIA.—The Central Moravian Electricity Co. of Prerau, jointly with the Moravian-Silesian Electricity Co., has decided to erect a large new thermal power station of an ultimate capacity of 160,000 kW at Strebowitz. The initial capacity will be 40,000 kW, and orders for two 20,000-kW turbo-generator sets, boilers, &c., have already been placed.

BELGIUM.—According to a recent report there are now about 112 miles of distribution mains in the city of Brussels, and the sales of power last year totalled 44,706,781 kWh. D.c. is still largely used for the operation of motors in the city, 6,861,387 kWh being used for this purpose in 1929.

Ealing.—EXTENSIONS.—The Borough Council has agreed to an expenditure of £2,900 for the extension of h.p. and l.p. mains and for the erection and equipment of a sub-station in connection with the supply of electricity to houses on the Hangar Hill Garden Estate. A sum of £5,550 is also to be spent to supply houses on the Priory Park estate.

Hailsham (Sussex).—ELECTRICITY SUPPLY SCHEME.—The Rural District Council has decided to support an application by Major C. de Roemer for a Special Order to supply electricity within a mile radius of Gardner Street, including Herstmonceaux. The prospective prices are 8d. per kWh for lighting, and 1½d. per kWh for power. Under the scheme there is to be free wiring, with the free installation of a small electric cooker in each house.

Hazel Grove and Bramhall.—ALL-IN TARIFF INTRODUCED.—The Urban District Council has adopted an all-in tariff with a fixed charge of 20 per cent. of the net rateable value per annum up to £100 plus 10 per cent. of the net rateable value in excess of £100, and a "unit" charge of ¼d. This rate applies only to residences.

Isle of Wight.—NEW CHARGES.—The public authorities in the Island have come to an arrangement with the Isle of Wight Electric Light & Power Co., Ltd., for an alteration in

the charge for electricity for a period of years. The new charge is to be a flat rate of 8d. per kWh.

Japan.—SUB-STATIONS FOR OSAKA RAILWAY.—Plans are now being prepared for the new sub-stations required for the Osaka Municipal Rapid Transport Railway. About ten large sub-stations are to be erected and work on the construction of those at Umeda, Shinsaibashi and Tennoji will be commenced early in 1931. Tenders for the necessary equipment will be invited about next April.

NEW POWER STATION.—The Fuji Power Co., No. 2, has received sanction to the erection of its proposed 18,000-kW Yuyuma station.

Keighley.—SHOP-WINDOW LIGHTING.—The Corporation Electricity Committee proposes to supply electricity for shop-window lighting after 7.30 p.m. at 1d. per kWh. The existing charge is 4½d. per kWh.

Keith.—STREET LIGHTING.—The Town Council has decided to enter into a street-lighting contract with the Grampian Electricity Supply Co.

Kendal.—LOANS.—The Town Council has applied for sanction to a loan of £6,000 for mains and services.

Liverpool.—PROPOSED EXTENSION OF SUPPLY AREA.—Negotiations have been opened between the West Lancashire Rural District Council and the Liverpool Corporation with regard to electricity supply in the districts of Maghull, Lydiate and Aughton. The consumers in these districts considered the charges for electricity to be too high and this led the Rural Council to make approaches to the Corporation for a reduction in the bulk supply charges. The Corporation made concessions conditional upon certain retail prices being agreed to, but these would have involved a loss to the Council. The alternative proposal put forward by the Liverpool Corporation was that it should take over the scheme for the supply of electricity to Maghull, Lydiate and Aughton and give the residents a cheaper service of electricity. The Rural District Council now charges 8d. per kWh and the Liverpool Corporation has offered 4½d. per kWh and after April next 4d. per kWh, together with corresponding reductions for power. A sub-committee of the Rural Council has been given power to negotiate for the transfer of the Maghull, Lydiate and Aughton scheme to the Liverpool Corporation.

London.—HAMMERSMITH.—In connection with the three new e.h.p. sub-stations to be provided adjoining Broadway Chambers, near Down Place and in Hythe Road, the Borough Council Electricity Committee recommends that mains extensions and other works shall be carried out at a total estimated cost of £21,626. The Committee also recommends that the Wood Lane sub-station shall be extended for the purpose of giving a supply of electricity to the premises of Callender's Cable & Construction Co., Ltd.

FULHAM.—The borough electrical engineer reports that since the contracts for wiring consumers' premises were fixed, there have been reductions in costs of materials and wages. The Electricity Committee has, therefore, decided to invite new quotations with a view to arranging a revised schedule. Meanwhile the contractors are to be offered new contracts at 1s. per point reduction upon the present schedule.

The Council has received sanction to loans of £5,313, for the provision and equipment of sub-stations at North-End House and Rivermead Court, and £13,256 for the laying of h.p. cable in the West Kensington and Hurlingham districts.

STOKE NEWINGTON.—The Borough Council Electricity Committee recommends the extension of mains at an estimated cost of £1,022.

ST. PANCRAS.—Mains extensions estimated to cost £1,080 are to be carried out by the Borough Council Electricity and Public Lighting Committee. The Council has received sanction to loans of £18,024 for mains and services, £12,071 for meters, £3,060 for house wiring installations and £5,174 for domestic appliances.

HACKNEY.—The Borough Council Electricity Committee proposes to give a supply of electricity to the new premises of the British Industrial Gases, Ltd., at an estimated cost of £2,250.

Lutterworth.—SUPPLY TO HOUSING ESTATE.—The Rural District Council has received from the Ministry of Health sanction to install electric lighting at houses at Misterton on condition that not less than 3d. per week is added to the rent.

Northern Ireland.—LONDONDERRY.—At a recent meeting of the Corporation Lighting Committee it was decided to recommend the extension of electric lighting at Shantallow.

COLERAINE.—For some time past the Borough Council has been divided upon the subject of its electricity supply. In view, however, of an outside company coming into the field, the Council has now made up its differences of opinion and has resolved to have a municipally-controlled scheme. The Electricity Commissioners are to be asked to make an extension of the original Order.

Portslade-by-Sea.—OVERHEAD LINE PROPOSALS.—At a recent meeting of the Urban District Council a letter was read from the East Sussex County Council asking for the Portslade Council's views regarding the proposals of the Central Electricity Board to erect a 132,000-V transmission line from Brighton to Three Bridges. The Council decided that the Board should be requested to place the line under ground across the Downland portion; or, if it had to be overhead, that it should be placed along the same route as the Summersdene Valley line.

Purfleet (Essex).—STREET LIGHTING.—At a recent meeting of the Urban District Council it was announced that, as electricity was proving far cheaper than gas for street lighting, it was proposed further to extend the service of the County of London Electric Supply Co., Ltd., by the erection of a large number of new electric light standards in the district.

South Africa.—PAARL.—The Town Council has unanimously decided to break away from the Electricity Supply Commission by not renewing the contract which expires on December 31st, 1931. The Council has also decided to erect its own power station and plant and to extend and renew mains at a total cost of £70,000. Negotiations with the Commission to obtain cheaper electricity have failed, and as Paarl is anxious to develop as an industrial centre, progress is hindered. The present charge for electricity for private consumers is 9d. per kWh. Paarl is the largest country customer of the Commission; it is now consuming four million kWh per annum and aims at selling at least ten million kWh. A report on the new scheme prepared by Mr. A. E. Val Davies, consulting engineer, Cape Town, has been approved.

South Shields.—ASSISTED WIRING SCHEME.—The Corporation Electricity Committee has revised the list of electrical installation contractors for the assisted wiring scheme owing to the large number of approved contractors having ceased business or left the town.

Stoke-on-Trent.—CHANGE-OVER.—In connection with the change-over from d.c. to a.c., the Corporation Electricity Committee has decided to extend the existing three-phase main in Mayer Street at a cost of £700. Arrangements are also to be made for the change-over of supply in the Broom Street area, at a cost of £1,000; in a further portion of Hope Street, Hanley, at a cost of £800; and in the Newport Lane area and a further section of Waterloo Road, Burslem, at a cost of £6,500.

BULK SUPPLY.—At a recent meeting of the Electricity Committee it was reported that the Stone Urban District Council had intimated that it would be prepared to take a bulk supply of electricity for Rough Close as soon as a supply could be made available. The engineer was authorised to make the necessary arrangements for giving the required supply.

THREE-PHASE SUPPLY EXTENSIONS.—The Corporation Electricity Committee has decided to carry out underground and overhead work costing £8,700, for the purpose of giving a three-phase supply to the Brownhills Tileries of Messrs. D. Platt and Sons, Ltd., and to Tunstall Sewage Works.

Sunderland.—PROPOSED EXTENSIONS.—The Corporation Electricity Committee is to consider a proposal to extend its electric lighting system into the main streets of Southwick.

Tonbridge.—ASSISTED WIRING.—The Rural District Council has arranged for the Tunbridge Wells Corporation to wire houses in the rural area, and to fix shilling prepayment meters. Electricity will be supplied at 7½d. per kWh, and to recover the cost of the wiring, this price is to be continued for approximately ten years.

Tramway and Railway Notes.

Accrington.—TRAMWAY ABANDONMENT.—The Corporation Transport Committee has decided to withdraw the trams on the Accrington-Clayton-le-Moors service at the same time as those on the Oswaldtwistle route. Motor-omnibuses are to be substituted on both sections.

Brighton.—RATEPAYERS REJECT TRAFFIC MERGER PROPOSAL.—By 815 votes to 403 a meeting of Brighton ratepayers rejected the proposal to establish a Traffic Board to control the transport of Brighton and Hove. Hove ratepayers, on the other hand, have voted unanimously in favour of the project. At a subsequent meeting of the Brighton Town Council it was decided to take a poll of the town on the question.

Continental.—RUSSIA.—It is reported from Moscow that the Railway Commissariat has decided to electrify 1,500 km of line by 1933, and 16,000 km of line in the new five years' plan beginning with 1933.

Japan.—NEW ELECTRIC RAILWAY.—Work on the construction of an electric railway between Nikko and Chuzenji is to be commenced in September, 1931.

London.—IMPROVEMENT OF TRAMCARS.—As a result of experiments for providing protection for motormen on the tramcars during inclement weather, the Highways Committee of the London County Council proposes that the driving platforms of 100 tramcars shall be equipped with vestibule front screens, the metal frames of which will be filled with safety glass. The

work, which is estimated to cost £15,700, will be carried out by direct labour in the Tramways Department.

THE KINGSWAY TUNNEL.—The work of enlarging the tramway tunnel between Victoria Embankment and Southampton Row is now almost completed and the official opening will take place shortly.

THROUGH-RUNNING AGREEMENT.—The London County Council Highway Committee recommends that an agreement be entered into with the Walthamstow Corporation for the through-running of trams between Bloomsbury and the Napier Arms, Walthamstow.

Manchester.—NO RAILLESS CARS FOR THE PRESENT.—At a recent meeting of the Corporation Transport Committee a report was presented by the deputation which had visited various towns where railless-car systems are in operation. Most of the members of the deputation were apparently not favourably impressed with the system and consequently the Committee decided not to make application for powers to run railless cars, at any rate for the present.

TRIAL RUN ON THE ALTRINCHAM LINE.—In connection with the electrification of the Manchester, South Junction and Altrincham Railway, which line is controlled jointly by the London, Midland & Scottish and the London & North Eastern Railways, a very successful trial run took place recently on the first length of track to be equipped. The trial was attended by a number of officials of the two railway companies and of the General Electric Co., Ltd., the contractors for the rolling stock electrical equipment. It is understood that the train operated in a highly satisfactory manner, a speed of nearly 60 m.p.h. being reached. This is the first 1,500-V d.c. multiple-unit train to be operated in this country following the adoption of this pressure as standard by the Ministry of Transport.

Telegraph and Telephone Notes.

International Telephony. — ANGLO-GERMAN SERVICE. — In order to meet the continued growth of traffic between this country and Germany, additional telephone circuits have been brought into service to Berlin and Cologne, making a total of 23 connecting this country with Germany. Of these 23 circuits, which at this end are all worked from the London trunk exchange, nine terminate in Berlin, seven in Hamburg, two each in Cologne, Dusseldorf, and Frankfort (Main), and one in Bremen.

South Africa.—RURAL TELEPHONY EXTENSION.—Mr. H. W. Sampson, the South African Minister of Posts and Telegraphs, states that the mileage of farm telephone wires has increased from 4,000 in 1924 to 27,000 at the present time. The construction of new lines is proceeding at the rate of about 4,000 miles annually. The telephone tariffs are to be overhauled as from April 1st next, and a fixed minimum rate will be laid down with the object of assisting farmers at long distances from the main centres.

Telephony.—STATISTICS.—Telephones in use in the world increased by nearly a million and three quarters during 1929; the total number was approximately 34,400,000. Britain is still tenth among the great telephone-using peoples of the world, reckoned on the basis of the number of instruments per hundred inhabitants; three of her dominions (Canada, New Zealand, and Australia) are ahead of her. The following list shows the number per 100 inhabitants in all countries with upwards of 100,000 telephones and a ratio of telephones to population of at least two per cent.: United States 16.9, Canada 14.4, New Zealand 10.8, Denmark 9.4, Sweden 8.3, Australia 8.2, Norway 6.6, Switzerland 6.5, Germany 5.0, Great Britain 4.2, Netherlands 3.7, Finland 3.4, Austria 3.23, Belgium 3.2, France 2.6, Argentina 2.4. The steady progress made by Europe in 1929 with a record of 773,000 telephones (or 8.4 per cent.) compares with North America's increase of 816,000 (3.9 per cent.). The largest percentage increases in Europe are to be found in countries whose telephone density has hitherto been below the average. Spain increased by about 37,000 (24 per cent.), Italy by about 52,000 (17 per cent.), Belgium by 33,713 (15 per cent.), Russia by about 36,000 (12 per cent.), and France by 90,515 (over 9 per cent.). Of the highly-developed countries, Switzerland also increased by more than 9 per cent. and Sweden by nearly 5 per cent.; Germany increased by 231,876 and Great Britain by 127,040. These two countries provide more than half the total number of telephones in Europe.

The extent to which a highly-developed telephone service provides work and disburses money in wages is shown in the latest report by the chief statistician of the American Telephone and Telegraph Company. The telephone industry of the United States employs more than 500,000 workers, of which 421,000 are on the operative side and 81,350 are engaged in laboratory work; these numbers are exclusive of those engaged in ancillary trades. More than £8,927,000 was paid in the month of June last in salaries to employés of the Bell system, which, as the largest telephone organisation in the United States, employs approximately 350,000 workers, 222,000 of whom are women.

The Telephone Service.—TRUNK CALLS.—A new device for giving warning of the end of the three-minute period allowed for a trunk call is being tried by the Post Office on the London-Birmingham trunk circuit. Instead of the voice of the operator breaking in on the conversation, an automatic buzzer sounds about ten seconds before the full period is up. This allows time for the conversation to be concluded, or for a decision to be made to continue it for a further period.

Radio Notes.

India.—SUGGESTED IMPROVEMENTS.—Our correspondent in India reports that in an attempt to stimulate the broadcasting service prizes were offered some time ago for constructive essays. The Postmaster-General of Bombay acted as examiner and the best essay selected by him was written by Mr. S. R. Bellimal, who considers that the progress of broadcasting in India depends to a large degree on the cheapness of reception. He makes a number of suggestions to reduce its cost, the principal of which are (1) increasing the power of the Calcutta and Bombay stations; (2) simultaneous broadcasting on long and short waves from those two stations; (3) equipping the present Government stations at Nagpur, Allahabad, Lahore, and Delhi, and an additional station at Bangalore with suitable broadcasting transmitters of 1 or 1½ kW each and utilising them to relay the Bombay and Calcutta programmes and also to broadcast local programmes of their own. It is stated that if the above suggestions were adopted the areas of reception with crystal sets would be increased by about ten times; further, simple two-valve receivers should pick up the Bombay and Calcutta programmes within 300 miles at loud-speaker strength, and beyond the skip distance of the short wave simple two-valve short-wave sets should give good reception up to about 100 miles practically free from atmospherics. By such arrangements it is hoped that practically the whole of India will be capable of receiving programmes from one or the other of the stations at the minimum cost. Steps will have to be taken to bring home to the public the advantages of broadcasting. Receiving sets should be installed in public gardens at important functions, in almost all towns, and also every important village should have at least one radio set in charge of the headman. Landlords of flats in cities should be induced to install a receiver in each building from which loud-speakers should be led to the various flats at a monthly charge of Rs. 5 per loud-speaker. Special talks should also be given to ladies on domestic matters, fashions, cooking, sewing, needle work, &c. According to *The Times* a proposal to provide three new powerful inland stations, in addition to those existing at Bombay and Calcutta, will be considered by the Central Broadcasting Advisory Committee on December 20th.

New Station.—SCOTTISH REGIONAL SITE.—The B.B.C. announces that the site of the Scottish regional transmitting station has been chosen at Westerglen, three miles south of Falkirk, in Stirlingshire. The work of building the station is being put in hand immediately, the design being similar to that adopted for the London and north regional stations. The new station will be the third twin transmitter to be built as part of the Corporation's regional scheme and will, when in operation, replace the existing low-power transmitters at Glasgow, Edinburgh, and Dundee.

New Zealand.—GOVERNMENT CONTROL.—The existing contract with the Radio Broadcasting Company of New Zealand expires in January, 1932, and from that date it is proposed that the Post and Telegraph Department shall assume control of the technical side of the service, but the programme side will be left largely in other hands. It is proposed that the YA stations in Auckland, Christchurch, and Dunedin shall increase their power to 2,000 watts and that eight subsidiary 500-watt stations shall be erected in other towns, so that there will be a chain of Government stations throughout the Dominion. The smaller stations will be mainly for relay purposes, but will also be used to broadcast any events of outstanding importance in their respective localities. It is not proposed to do away with the "B" class, or privately-owned, stations, says *World-Radio*, but they will be required to reach a high standard. Their interests will be protected, and legislation will be brought in next year to prevent any association making extortionate demands for copyright fees. The proposals have not yet been ratified by Parliament, and many details have still to be worked out.

Radio Exchange.—SOUTHAMPTON.—Details of a scheme for the installation of a relay broadcasting service have been laid before the Southampton Town Council and it is anticipated that it will be accepted. The charge will be 1s. 6d. per week and the company has offered to pay to the Corporation £250 for every 1,000 subscribers, with a minimum payment of £500 per annum.

Switzerland.—NEW TRANSMITTERS.—We learn from Zurich that the construction of the new transmitters at Sottens and Munster is rapidly proceeding. It is expected that they will be in operation by February, 1931.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—Posts and Telegraphs Department. January 13th. Terminal strips. (A.X. 10465.)* Four sets of echo suppressors for two-wire repeated circuits. (A.X. 10523.)*

January 20th. Telephone switchboard keys and parts, including handles, make springs, break springs, and key plates. (A.X. 10517.)*

January 27th. Fuses and heat coils for the protection of telephone equipment. (A.X. 10516.)*

February 3rd. Telephone exchange power boards. (A.X. 10466.)*

February 10th. Telephonists' telephones for common battery working. (A.X. 10569.)*

February 17th. Electric lamps, lamp caps and sockets for voltages from 4 to 50. (A.X. 10643.)*

February 24th. Resistances in vitreous spools ranging from 100 to 4,000 ohms. (A.X. 10642.)*

State Electricity Commission. January 12th. 44,000-V switchgear and accessories for the Belmont and Colac sub-stations. (A.X. 10543.)*

Barking.—January 12th. U.D.C. Electricity Department. Sub-station switchgear plant. (December 19th.)

December 30th. U.D.C. Education Committee. Electric wiring and fittings at the Eastbury School. (See this issue.)

Belgium.—BRUSSELS.—January 7th. Post and Telegraph Authorities. Supply and laying of quantity of telephone cable in the Liége and Metter districts. Specification (Cahier des Charges Special No. 3,523) for 13 fr. from Regie des T. et T., Brussels.

Bridlington.—January 19th. Corporation. 11-kV and l.p. cables, boxes, and roadwork; also 11-kV ring-main switchgear, transformers, and equipment. (December 19th.)

Heston and Isleworth.—January 9th. Electricity Department. Electrical supplies for twelve months. (See this issue.)

Hull.—January 19th. Corporation Electricity Department. Electric lamp-posts and brackets for street lighting. (December 12th.)

London.—ISLINGTON.—Borough Council. January 1st. Lead battery. (December 12th.)

January 16th. Twelve months' supply of electrical and engineers' stores. (December 12th.)

COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD.—February 2nd. Coal unloading cranes and coal-handling plant, including travelling bridge and belt conveyors, in connection with the Barking power station extensions. (December 12th.)

CENTRAL ELECTRICITY BOARD.—January 19th. Construction of site works, foundation works and buildings in connection with the North-East England Electricity Scheme. (December 12th.)

New Zealand.—WELLINGTON.—Post and Telegraph Department. January 19th. Electric lamps and condensers. (A.X. 10446.)*

January 20th. Resistance spools. (A.X. 10505.)*

January 24th. 300 four-conductor dial cords. (A.X. 10556.)*

January 26th. 500 ebonite telephone earpieces. (A.X. 10555.)*

Public Works Department. January 27th. 11,000-V switchgear and metering for Mangahao power scheme. (A.X. 10373.)*

February 24th. One set of 110-kVA outdoor switchgear, steelwork and controlling equipment. (A.X. 10507.)*

Plymouth.—January 10th. Corporation. 15,000-kW turbo-alternator with condenser auxiliaries. (December 19th.)

South Africa.—JOHANNESBURG.—January 26th. Railways and Harbours. One 5-ton electric overhead travelling crane. (A.X. 10650.)*

Southend-on-Sea.—January 21st. Electricity Department. General stores for 12 months. (December 19th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Bexhill.—Electricity Committee. Recommended:—
Reconditioning of positive plates of storage battery.—Tudor Accumulator Co., Ltd.

Gravesend.—Town Council. Accepted:—
Cables.—W. T. Henley's Telegraph Works Co., Ltd.

Government Contracts.—The following contracts were placed by the various Government Departments during November:—

ADMIRALTY (CONTRACT AND PURCHASE DEPARTMENT).

Torch batteries.—Siemens Bros. & Co., Ltd.; General Electric Co., Ltd.

Motor booster, switchboard, &c.—General Electric Co., Ltd.

Motor booster set and main motors.—Laurence, Scott and Electromotors, Ltd.

Artificial silk shades.—Best & Lloyd, Ltd.; Louis Dernier and Hamlyn, Ltd.

Wire.—Telegraph Construction and Maintenance Co., Ltd.

AIR MINISTRY.

Accumulators.—Chloride Electrical Storage Co., Ltd.

Batteries.—Siemens Bros. & Co., Ltd.

W/T condensers.—Dubilier Condenser Co. (1925), Ltd.

Generators.—British Thomson-Houston Co., Ltd.

Plug sockets and transmitters.—Siemens Bros. & Co., Ltd.

Voltmeters.—Ferranti, Ltd.

CROWN AGENTS FOR THE COLONIES.

Cables.—British Insulated Cables, Ltd.

Copper.—T. Bolton & Sons, Ltd.

Generating plant.—Spensers (London), Ltd.

Train-lighting spares.—J. Stone & Co., Ltd.

Wireless apparatus.—Radio Communication Co., Ltd.

OFFICE OF WORKS.

Electric passenger lift (Chelsea Royal Hospital).—Wm. Wadsworth & Sons.

Change-over switch, &c. (Royal Courts of Justice).—Electrical Installations, Ltd.

GENERAL POST OFFICE.

Protective apparatus.—Phœnix Telephone and Electric Works, Ltd.; Power Equipment Co., Ltd.

Telegraphic apparatus.—Creed & Co., Ltd.

Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd.; Ericsson Telephones, Ltd.; General Electric Co., Ltd.; North British Rubber Co., Ltd.; Plessey Co., Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.; Telephone Manufacturing Co. (1929), Ltd.

Wireless apparatus.—General Electric Co., Ltd.; Standard Telephones & Cables, Ltd.

Distributing boards.—Edison Swan Electric Co., Ltd.

Cable.—British Insulated Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Enfield Cable Works, Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; Johnson & Phillips, Ltd.; Siemens Bros. and Co., Ltd.

Conduits.—Longmore Bros.

Cords for telephones.—Phœnix Telephone and Electric Works, Ltd.

Lead sleeves.—George Farmiloe & Sons, Ltd.; J. D. Stoward & Co., Ltd.

Insulating tape.—Pomona Rubber Co.

Electric trucks.—Greenwood & Batley, Ltd.

Traction wheels.—English Electric Co., Ltd.

Supply, drawing-in and jointing of cable.—Bristol-Frome-Warminster.—W. T. Henley's Telegraph Works Co., Ltd.

Motor generator sets, cables and switchgear (Leeds head post office).—General Electric Co., Ltd.

Power plant (Bristol telephonic repeater station).—General Electric Co., Ltd.

Telephone exchange equipment.—Tile Hill (Coventry automatic area); Boscombe; Canford Cliffs; Parkstone, Southbourne.—General Electric Co., Ltd.; Rainham (Chatham multi-exchange area); King's Norton (Birmingham area).—Siemens Bros. & Co., Ltd. Sub-contractors for King's Norton: English Electric Co., Ltd., for charging machine; Chloride Electrical Storage Co., Ltd., for batteries. High Wycombe; Preston (Brighton multi-exchange area).—Siemens Bros. & Co., Ltd. Sub-contractors: English Electric Co., Ltd., for charging machines; Crompton Parkinson, Ltd., for ringing machines; Hart Accumulator Co., Ltd., for batteries. Trafford Park (Manchester).—Automatic Telephone Manufacturing Co., Ltd. Smethwick (Birmingham area).—Ericsson Telephones, Ltd. Sub-contractors: Electric Construction Co., Ltd., for motor generators and ringing machines; Pritchett & Gold & E.P.S. Co., Ltd., for batteries. Calthorpe (Birmingham area).—Standard Telephones and Cables, Ltd. Sub-contractors: Crompton Parkinson, Ltd., for motor generators and ringing machines; Tudor Accumulator Co., Ltd., for batteries.

Telephonic repeater equipment.—Edinburgh: Standard Telephones & Cables, Ltd. Birmingham: General Electric Co., Ltd.

Lichfield.—City Council. Accepted:—
Wiring houses at Dovehouse Fields for electric lighting (£141).—W. B. Haddock & Co.

London.—STOKE NEWINGTON.—Electricity Committee. Recommended:—
Cable (£1,615).—Metropolitan Electric Cable & Construction Co., Ltd.
Prepayment meters.—Measurement, Ltd.
Installation work under the assisted wiring schemes.—A. R. Camidge & Co.

Luton.—Education Committee. Accepted:—
Installation of electrical heating apparatus at Oakley Road schools (£208).—A. T. Snowden.

Seaford.—Urban District Council. Accepted:—
Installation of electric light at the municipal buildings (£163).—P. Nutcherd.

Sittingbourne.—Urban District Council. Accepted:—
Electric power drives, &c., for the electrification of Keycol Hill waterworks (£1,065).—Burdette & Co., Ltd.

Stoke-on-Trent.—Public Assistance Committee. Accepted:—
Installation of electric light at new hospital (£1,321).—Barnett & Soames.
Installation of lifts in hospital pavilion (£1,125) and in nurses' home (£967).—John Bennie, Ltd.
Electric cooker at Turnhurst Road institution (£91).—General Electric Co., Ltd.
Piping alterations in connection with generators at Turnhurst Road institution (£162).—Couzens & Akers.

Electricity Committee. Accepted:—
Erection of overhead wiring and service lines on Etruria Vale estate (£98).—E. Holloway.

Corporation. Accepted:—
Electric lighting at 55 houses on Civian Road estate, Fenton.—Public Works Department.

Forthcoming Events.

Royal Institution.—December 30th, January 1st and 3rd. Institution, London. Juvenile Christmas lectures.

Institution of Electrical Engineers (Meter and Instrument Section).—Friday, January 2nd. Institution, London. 7 p.m. "Apparatus and Methods for Accurate Maintenance of Large A.C. Energy Meters." Messrs. E. Fawssett and G. E. Moore.

Physical and Optical Societies' Exhibition.—January 6th-8th. Imperial College of Science, Kensington, S.W. Annual exhibition.

Electrical Engineers' Ball.—Friday, February 13th. Grosvenor House Hotel, Park Lane, W.

Diesel-electric Tanker.

The Diesel-electrically-propelled oil tanker *Winkler*, built by Scott's Shipbuilding & Engineering Co., Ltd., Greenock, for the Atlantic Refinery Co., was on trial on December 16th. Four 600-kW, 250-volt generators, working in series, are driven by 750-b.h.p. Carels-Ingersoll-Rand, six-cylinder, airless-injection engines, running at 225 r.p.m. The propelling motor is capable of transmitting 2,800 s.h.p. at 95 r.p.m.

Notes.

Reservoirs (Safety Provisions) Act, 1930.

This Act, which comes into force on January 1st, 1931, lays down certain requirements as to the construction and inspection of large reservoirs as defined in the Act and, among other things, will require undertakers with such reservoirs to keep records in the prescribed form of water levels, leakages, and other particulars. The regulations prescribing the particulars and form of record (and also prescribing the various forms of certificates under the Act) are about to be issued by the Home Office in book form and will be on sale at H.M. Stationery Office at the beginning of the new year.

Turbo-Electric Liner.

The *President Hoover*, the first of the two new turbo-electric liners built for the Dollar Steamship Lines, was christened by Mrs. Herbert Hoover on December 9th. The two ships are the forerunners of a fleet of four.

A Rural-electrification Scheme.

An important stage in the development of electricity supply in the Brighton rural area was marked by a luncheon given by Mr. Ambrose Gorham, the squire of Telscombe, on December 16th, in appreciation of the advantages thus conferred upon this little Downland village. The supply was first afforded to Telscombe Cliffs from the Brighton Corporation electricity undertaking on October 27th last. In view of the building development which is likely to take place within the next few years, the possibilities of a ring main from the Portobello sub-station around the east and north boundaries of the Brighton area have been investigated. In the first instance this main will be operated at the existing pressure of 8,000 volts, but provision has been made for the voltage to be increased to one of the standard intermediate pressures at a later date. The total length of the new ring main will be eight miles, 0.1 sq. in., and the first section of it has just been completed, consisting of 1,100 yards of underground cable from Portobello sub-station to Telscombe Tye, and a mile of overhead line from which a spur line has been taken to the little village of Telscombe, where a 30-kVA Crompton Parkinson outdoor transformer sub-station has been provided, and to which the supply was first commenced on December 14th. This little area is perhaps unique, as there are only 17 houses and cottages, of which 13 were available to take the supply when it was first switched on, excluding sundry farm buildings which are not wired. It is interesting to observe that electric cooking has been adopted under some very interesting conditions. Three small cottages belonging to farm employés are each equipped with a cookerette and an electric kettle, in the larger houses electric cookers are also included, whilst in the largest house a refrigerator and electric fires are already quite popular. Although the village church has been lighted electrically for some time from a small lighting plant, during the change-over the opportunity was taken to floodlight the chancel, and the effect of this on a 12th century church is very striking. Tubular heating has been adopted in the village club, and the various drives for the farm implements will be changed over from petrol engines to electric motors as soon as opportunity permits.

Investigations showed that it was an economic proposition to lay the distribution cables underground, and to give an indication of the size of the district it should be noted that the total length of the distributor from the outdoor sub-station is only 225 yards. A feature of the scheme is the short time in which the work was carried out. The transformer equipment was ordered on November 12th, the work on the overhead lines was commenced on November 27th, and supply was available by December 14th. This section of the ring main was carried out by Messrs. Siemens Bros. & Co., Ltd., to the specification of the engineer and manager of the Brighton Corporation Electricity Department. At the same time a parallel section of the ring-main is being erected, which will afford a supply from the Kemp Town sub-station to Warren Farm, with a tee-off to a housing estate which is now under consideration.

In view of the opposition which has been directed against the use of overhead lines on the Sussex downs, it is interesting to record the insignificant objections which have been raised to the erection of these lines.

At the celebration luncheon Mr. Gorham, recalling the protest meeting held in Brighton against the erection on the Downs of the chain of transmission towers, said that anyone energetic enough to walk or ride over the Downs could still get all the exercise he wanted, towers or no towers.

Mr. W. N. C. Clinch, engineer and manager, Brighton electricity undertaking, presented to Mr. Gorham and the Mayor of Brighton, Ald. Sidney C. Thompson, J.P., silver paper weights modelled in the form of electrical switches, and paid tributes to his predecessor, Mr. John Christie, who was present at the luncheon, to Messrs. Siemens Bros., and to Mr. Gorham.

Appointments Vacant.

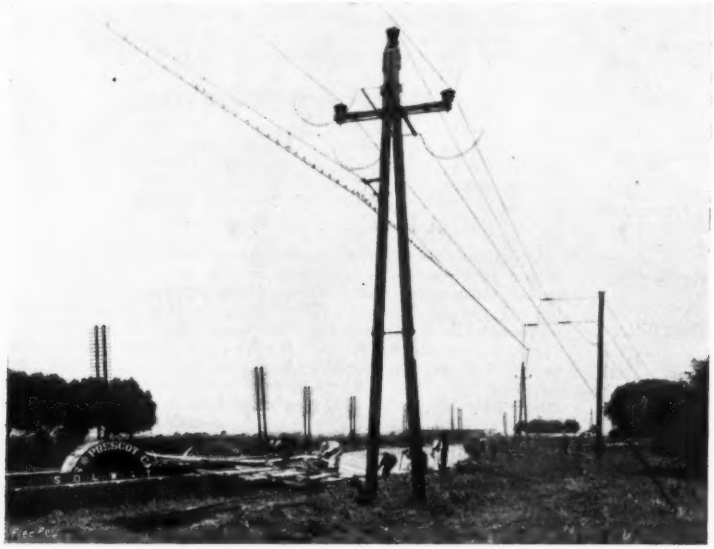
Distribution assistants for Great Yarmouth Electricity Supply Department.

Distribution engineer for Brighton Electricity Department.

(See our advertisement pages to-day.)

" Northmet " Developments.

We are indebted to the North Metropolitan Electric Power Supply Company for the accompanying illustration depicting one of its cable gangs laying super-pressure cable alongside the River Lea Navigation. The 33-kV cable, which is to connect Brimsdown and Ferry Lane, is shown being pulled directly off drums mounted in steel barges. A further point of interest in the illustration is the pull-off arrangement on the overhead line. This was necessitated by the fact that, with the line in its original position, sailing yachts, when heeling over, came dangerously near the line. It was found practicable to give adequate clearance by means of the arrangement shown, which, of course, was considerably less expensive than moving the line itself.



Transmission Lines on Lea Navigation Bank.

Oil-electric Trains.

Mr. C. J. Hyde Trutch, of the Diesel-electrical Traction Department of Sir W. G. Armstrong Whitworth & Co., Ltd., speaking at a meeting of the Institute of Transport in London, contended that many advantages would be obtained if British railways adopted the oil-electric engine in place of the steam locomotive. He estimated that the following maximum savings would be effected each year:—

	£
Maintenance	6,000,000
Fuel	8,400,000
Engine staff wages	4,000,000
Water	850,000
Total	£19,250,000

It might be argued that the colliery companies would raise some outcry against the importation of oils to take the place of home-produced coal, but the 13,400,000 tons of coal consumed by the railways represented only 5.2 per cent. of the tonnage raised in 1929, and a small reduction of freight rates made possible by reduced operating expenses would, by increasing the competing power, be of far greater value to the collieries than the lost railway purchases. The time was not far distant, however, when sufficient oil would be produced from home-mined coal.

High-pressure Boilers.

One trend found in new plant employing 1,400-lb. steam pressure is that the economiser, reheater, and air heater have grown until they almost dwarf the boiler itself. An outstanding example, reported in *Power*, is the recently completed Gilbert station (formerly called Holland) in which each steam-generating unit has only 7,980 sq. ft. of water-evaporating surface, and supplies steam to generate 27,500 kW. In this installation the boiler represents only 12 per cent. of the total heating surface. The superheater accounts for 6.9 per cent.; gas heater, 17.2 per cent.; economiser, 17.6 per cent.; and air preheater, 46.3 per cent.

These astonishing proportions are explained in part by the comparative cost of high-pressure boilers, which suggests transfer of heating surface from the boiler to the economiser and air heater. Making allowance for some reaction when lower boiler costs arrive, and for the fact that a square foot of air-heating surface cannot properly be compared directly with a square foot of boiler surface, the change is still significant.

B.S.S. for Telegraph and Telephone Wire.

A slight revision of B.S. Specification No. 175-1927 " Bronze Wire and Cadmium-copper Wire for Telegraph and Telephone Purposes " has recently been issued by the British Engineering Standards Association. The revision has been found necessary in view of the fact that since the issue of the original specification the resistance per mile of bronze wire manufactured to the specification has been found to be considerably lower in some instances than the resistance of wire manufactured heretofore, this probably being due to a certain amount of cadmium being added to the bronze billets. Bronze wire having these characteristics is unsuitable from the point of view of the General Post Office, since trouble would inevitably occur when balancing A and B lines for resistance in the event of coils of wire from different manufacturers being used on the same work. As a safeguard against this state of affairs, a minimum value for the resistance per mile for this class of wire has been inserted in the specification, in addition to a maximum value. As regards the cadmium-copper wire referred to in the same specification, the same need for a minimum resistance does not arise, since the variation in the resistance from the standard value is, in practice, not very large. Another modification to the specification relates to the weight of coils of 40-lb. wire. The revised weights allow a wider lattitude to the manufacturer in making up his coils, thus largely overcoming the question of waste which has, in the past, been found to be a somewhat serious matter in the case of this particular size of wire. The Specification is one of a series for overhead-line wire for telegraph and telephone purposes which is being published in a single volume as Specifications Nos. 174-181, and may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria Street, London, S.W.1, price 2s. 2d., post free. Those who already possess a copy of the Specification may obtain a copy of the revision slip (Reference C.C. 2280) for B.S. Specification No. 175 free of charge on application, enclosing a stamped envelope.

A Combined Heating and Lighting Installation.

The accompanying illustration shows the basement of the premises of the Royal Copenhagen Porcelain Co., Ltd. This and another showroom on the ground floor are each heated entirely by means of " Morganite " 1-kW combined heating and lighting units, supplied by the Morgan Crucible Co., Ltd., mounted on the ceiling in two rows of five. The lighting is designed primarily to illuminate the ware on the shelves, the intensity over the centre of the floor being of lesser importance. It is claimed that the radiant heat received by the occupants enables comfort to be obtained at a lower air temperature than would be necessary if air heating were employed, thus

Combined Lighting and Heating Units in " China " Showroom.

materially reducing the running costs. By employing this type of heating fitting, the radiation may be concentrated over the portions of the floor normally occupied by customers, thus reducing the intensity of radiation in areas occupied by show tables, &c. Without increasing the loading, it is thus possible to improve the performance of the installation and again reduce the running costs.

A Lamp-renewal Scheme.

A new lamp-renewal scheme, prepared by Mr. J. W. J. Townley (borough electrical engineer) was approved by the West Ham Council at its meeting on December 16th. The scheme will apply to rental wiring consumers only and is looked upon as part of the maintenance of the installations put into small dwelling houses under the rental wiring scheme. The necessity for this scheme was that, in many of the smaller installations, lamps which had burnt out or had been broken were not being replaced, with resultant loss of revenue to the undertaking. Many instances were found of a single lamp being moved from room to room as required because the occupiers of the house would not expend the necessary sums for the replacement of the defective lamps on account of their cost. Even 1s. 10d. is much too high a price for consumers in the poorer parts of the town to pay, bearing in mind that the family income is, in many cases, considerably less than £3 per week. The arrangements provide for an initial inspection of all installations, the filling of all lampholders from which lamps are missing, and the replacement of existing lamps with lamps specially marked. In future these marked lamps, when burnt out, will be returned to the showrooms, and new lamps given in exchange. Only lamps with the glass intact will be replaced in this way. As this arrangement will not cover the cases in which lamps have aged, or become accidentally broken, periodic inspections (about one per annum) of the rental wiring installations will take place, and all badly blackened lamps will be replaced and empty lampholders refilled. It is estimated that the increased consumption will largely, if not entirely, pay the cost incurred. The essential feature of the scheme is, of course, that the majority of the lamps will be replaced without book-keeping or other charges to the Department. The number of lamps to be replaced per annum is estimated to be from 12,000 to 15,000.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

The retirement of **Mr. J. Herrlein**, after 46 years' service as apparatus works manager of Standard Telephones & Cables, Ltd., was marked by a gift subscribed for by over 3,000 employés. The ceremony took place on Tuesday last at the New Southgate factory, and the other works at Hendon and North Woolwich, as well as the London offices, were linked by telephone tie-lines for the occasion, over which the speeches were transmitted and delivered, after amplification, to the separate audiences by loud-speakers. Thus the employés of the four places were enabled to follow the whole proceedings and hear the speeches made at the three factories by means of two-way working of the company's public-address system.

Captain J. McKeown, superintendent of the Telegraph Department, Belfast, has retired from the service, and **Mr. M. L. Gillespie**, assistant superintendent, has been appointed to succeed him.

Mr. Frank Ellinson, one of the pioneers of the telephone in the old "Lancashire and Cheshire" days, is to retire at the end of this year after 46 years' service.

Mr. G. C. B. Gerry is leaving the Tottenham Corporation electricity works to take up an appointment with the North Metropolitan Electric Power Supply Co.

Mr. A. Vines, of Messrs. Evershed & Vignoles, Ltd., was presented with an antique secretaire bookcase after the annual meeting, on December 16th, of the Engineering & Allied Employers' London & District Association to mark the completion of his three years' term of office as president of the Association.

The Rawtenstall Town Council, after considering matters connected with the Electricity and Tramway Departments, has decided that **Mr. C. L. E. Stewart**, electrical and tramway manager, shall be asked to resign his position, and Mr. Stewart's resignation is now in the hands of the town clerk. He has been borough electrical and tramway manager since 1909 and his present salary is £1,170 a year. Recently an official announcement was made that the dual post of electrical engineer and tramway manager was to be divided, Mr. Stewart to confine himself to the electrical undertaking, and a new tramway manager appointed.

Mr. R. Daw has been appointed deputy electrical engineer by the Dartford Urban Council in succession to **Mr. R. Jones**, who retires on superannuation, and **Mr. C. S. Landen** has been appointed assistant mains and consumers' engineer.

Sir Hugo Hirst, Bt., is to present a portrait in oils of the late Alexander Graham Bell, by Mr. W. W. Russell, R.A., to the Institution of Electrical Engineers at the ordinary meeting of the Institution on January 8th.

Sir Alexander Roger was presented with a piece of silver plate at the annual meeting of the Telephone Development Association on December 16th. The presentation was made on behalf of all the British manufacturers of telephone apparatus to mark their appreciation of Sir Alexander's activities as chairman of the Association since its inception six years ago, from which position he is now retiring.

Mr. Llewelyn B. Atkinson has been elected to the chairmanship of the T.D.A. in succession to Sir Alexander Roger.

At a meeting of the Croydon Corporation Electricity Committee last week, the town clerk reported the receipt of the resignation of **Mr. A. C. Cramb**, the borough electrical engineer, upon his appointment as Director and Secretary of the British Electrical Development Association. The Committee recommended that the position should be advertised.

Obituary.

Lt.-Col. R. W. Leonard.—The death is reported from Canada of Lt.-Col. Reuben W. Leonard, at the age of 70. Col. Leonard supervised the erection of a number of Canadian hydro-electric undertakings.

Mr. T. H. Smith.—The death is announced, at the age of 48 years, of Mr. Thomas H. Smith, who had for 17 years been electrical engineer to the Tudor Accumulator Co., Ltd.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares.

New Companies Registered.

Dynameg, Ltd.—Private company. Registered December 17th. Capital, £500 in £1 shares. Objects: To carry on the business of electrical engineers, general electrical installation contractors, manufacturers and repairers of and dealers in dynamos, motors, armatures, magnetos, rubber and insulating materials, radio engineers and contractors, &c. The first directors are:—R. Tilley, 41, Oriel Road, Bootle, Liverpool, building contractor; O. Beaby, 40 Hougoumont Avenue, Waterloo, Liverpool, engineer; Mrs. J. H. Thompson, "Sunrising," Valescourt Road, West Derby, Liverpool. Secretary: O. Beaby. Registered office: 41, Oriel Road, Bootle, Liverpool.

English Plastics, Ltd.—Private company. Registered December 12th. Capital, £15,750 in 15,000 8 per cent. cumulative preference shares of £1, and 15,000 ordinary shares of 1s. each. Objects: To carry on the business of manufacturers of and dealers in synthetic resin products and urea powders of all kinds, varnishes, paints, celluloid products and pigments, colour grinders, oil and colour men, motor accessories, electrical, wireless, optical, and scientific apparatus, batteries, domestic utensils, &c. The provisional directors are: R. D. Hyem and A. Urry, 5, Gray's Inn Square, W.C. Secretary (pro tem): H. Scholey. Registered office: 137, Victoria Street, S.W.1.

Golden Arrow Radio, Ltd.—Private company. Registered December 17th. Capital, £1,000 in £1 shares. Objects: To carry on the business of radio merchants and manufacturers, dealers in all kinds of radio goods, electricians, &c. The permanent directors are:—J. F. Berry, 8, Clarendon Road, St. Annes-on-Sea; E. Winterbotham, 2, Abbey Gardens, Birkdale, Southport. Solicitor: J. Prior, 7, Brazennose Street, Manchester.

Samuel Hunter & Co., Ltd.—Private company. Registered December 15th. Capital, £5,000 in £1 shares. Objects: To acquire the business of a brass and malleable ironfounder, &c., carried on by L. Heap, at 13, 14, 15 and 16, Duncalfe Street, Walsall, as "Samuel Hunter & Co.," and to carry on the same and the business of manufacturers of electrical accessories and conduit fittings, &c. The first directors are: L. Heap, 38, Harden Road, Leamore, Walsall, manufacturer (permanent); F. Heap, 33, Harden Road, Leamore, Walsall, manufacturer; L. C. Heap, 12, Stafford Street, Walsall, manufacturer. L. Heap is permanent managing director.

Torque Transformer Syndicate, Ltd.—Private company. Registered December 13th. Capital, £2,400 in £1 shares. Objects: To acquire and deal in patents, *brevets d'invention*, and licences; and to carry on the business of brokers or commission agents, merchants, engineers, shippers, carriers, &c., and to adopt an agreement with J. N. Waring, T. E. Beaumont, and R. Romeu. The directors are: J. N. Waring, 22, Grangecliffe Gardens, South Norwood, S.E., engineer; T. E. Beaumont, 144, Days Lane, Sidcup, engineer; R. Romeu, 57, Gunnersbury Avenue, W.5, merchant. Registered office: 34/6, Oxford Street, W.1.

Bastian & Allen, Ltd.—Private company. Registered December 13th. Capital, £5,000 in £1 shares. Objects: To carry on the business of electrical engineers and contractors, suppliers of electricity, carriers of passengers and goods, manufacturers of and dealers in railway, tramway, electrical, magnetic, galvanic, and other apparatus, &c. The subscribers (each with one share) are: A. E. Rudd, 5, Copers Cope Road, Beckenham, paper maker; F. J. C. Allen, The Gadget, Weybridge, electrical engineer; S. A. Williams, Vine Lodge, Church Road, Osterley, engineer. Solicitors: Macdonald, Stacey & Mant, 2 and 3, Norfolk Street, W.C.2.

Inductor, Ltd.—Private company. Registered December 15th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical, magnetic, galvanic, radio, and mechanical apparatus, electric and other telephones and telegraphs, gramophones, &c. The first directors are: S. N. S. Mee, Corner Cottage, Lutterworth Road, Leicester, engineer; C. A. F. Partridge, 50, Litchfield Way, Finchley, electrical engineer (chairman); F. V. Hewitt, Quorn Lodge, Cowbeech, Hailsham, Sussex, company director; J. F. Shaw, 18, Southway, Golders Green, engineer. Solicitors: Stone, Davis, Savige & Partridge, Leicester.

Finsbury Radio Co., Ltd.—Private company. Registered December 13th. Capital, £1,000 in £1 shares. Objects: To carry on the business of radio and television experts, importers, exporters, and manufacturers of and dealers in wireless and all kinds of electrical and gas goods and equipment, &c. The directors are: A. Wiseman and Mrs. B. Samuels, 46, Half Moon Lane, Herne Hill, S.E.24. Registered office: 103, Finsbury Pavement, E.C.2.

Official Returns of Electrical Companies.

Colston Electrical Co., Ltd.—Capital, £4,000 in £1 shares. Return dated September 20th, 1930. 2,646 shares taken up. £1,146 paid, £1,500 considered as paid. Mortgages and charges: £3,000.

Walsh & Stevenson, Ltd.—Capital, £4,000 in £1 shares. Return dated May 16th (filed December 4th), 1930. 1,975 shares taken up. £1,750 paid, £225 calls unpaid. Mortgages and charges at date of return, nil. Since registered: Debenture dated October 7th, 1930, to secure all moneys due or to become due from company to bankers.

Sydney Hellyar, Ltd.—Capital, £2,000 in £1 shares. Return dated October 21st, 1930. All shares taken up. £2,000 considered as paid. Mortgages and charges, nil.

W. Mackie & Co., Ltd.—Capital, £12,000 in £1 shares. Return dated October 2nd, 1930. 7,500 shares taken up. £3,155 paid, £4,345 considered as paid. Mortgages and charges, nil.

South London Electric Supply Corporation, Ltd.—Particulars filed of £300,000 debenture stock authorised by resolutions of November 23rd, 1926, and October 31th, 1930, and covered by trust deed dated December 8th, 1930, constituting a first floating security on the company's undertaking and property, present and future, including uncalled and unpaid capital, the whole amount being now issued. Trustees: Lord Inverforth, P.C., and Sir William G. Granet, G.B.E.

Southern Electric Free Wiring Co., Ltd.—Capital, £5,000 in £1 shares. Return dated September 30th, 1930. 1,510 shares taken up. £1,510 paid. Mortgages and charges, nil.

Lancashire Electric Light and Power Co., Ltd.—Capital, £3,171,415 in 571,415 first preference, 1,000,000 7 per cent. preference, and 1,600,000 ordinary shares of £1 each. Return dated June 16th, 1930. 511,440 first preference, 1,000,000 7 per cent. preference, and 1,600,000 ordinary shares taken up. £3,109,040 paid. £2,400 considered as paid. Mortgages and charges, nil.

Jersey Electric Lighting and Power Co., Ltd.—Capital, £65,000 in 51,000 preference and 14,000 ordinary shares of £1 each. Return dated September 13th, 1930. 12,257 preference and 14,000 ordinary shares taken up. £26,257 paid. Mortgages and charges, £9,000.

British General Manufacturing Co., Ltd.—Capital, £500 in £1 shares. Return dated October 7th, 1930. All shares taken up. £2 paid. £498 considered as paid. Mortgages and charges, nil.

Cawnpore Electric Supply Corporation, Ltd.—Capital, £547,986 in 200,000 preference and 347,986 ordinary shares of £1 each. Return dated May 27th, 1930. 200,000 preference and 200,000 ordinary shares taken up. £325,000 paid on 200,000 preference and 125,000 ordinary shares. £75,000 considered as paid on 75,000 ordinary shares. Mortgages and charges, £233,040.

O. S. Choppin & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated September 24th, 1930. 702 shares taken up. £2 paid. £700 considered as paid. Mortgages and charges, nil

Armaflex Parent, Ltd.—C. Latham, 78, New Oxford Street, W.C.1, was appointed receiver and manager on December 4th, 1930, under powers contained in debenture dated September 5th, 1930.

Hill Bros. (Magnetos), Ltd.—S. M. Bond, 19, Temple Street, Birmingham, ceased to act as receiver and manager on October 20th, 1930.

City Notes.

Allen West & Co., Ltd.

The annual meeting was held on December 18th, Mr. A. E. L. Slazenger (chairman) presiding. In presenting the report and accounts (*vide* ELECTRICAL REVIEW, December 19th, p. 1057), the chairman said he was glad to be able to report satisfactory progress in spite of general industrial depression at the present time, especially in the heavy industries in the home market, in whose welfare they were particularly interested. In view of the fact that 10 years ago the buying power of the heavy industries was moving from the home market to the Continent, they established there and elsewhere overseas a strong selling and technical service organisation, with the result that they had maintained and increased their sales, but to the heavy industries abroad instead of those in the home market. These sales had been effected by subsidiary companies, the growth of whose business was reflected in the increased investment shown in the balance sheet. Since that date their investment had again been increased by £44,638, and it was the confident belief of the directors that the orders secured would in the near future more than double their present sales. Among many important contracts secured by their Continental organisation were those for h.p. power-house and sub-station equipment for the City of Paris, for Strasbourg, the State mines of Holland, and for many other Continental enterprises. These contracts had not been obtained on price but on technical merit. They had succeeded in producing in their laboratories for the Reason Manufacturing Co., which they owned, an a.c. electrolytic meter, the registration of which was more accurate than that of any known meter on the market. It was not yet in commercial production, but they had great hopes of its future. Satisfactory progress had been made with the equipment of the Woolston factory, and part of the factory was now in full production. The manufacturing floor space of the company's various factories now covered an area of over 700,000 sq. ft. Mr. Slazenger concluded with grateful acknowledgments to Mrs. West for the splendid work done by her in connection with the welfare organisation. The report and accounts were adopted.

Yarrow & Co., Ltd.

The annual meeting was held on December 15th, Mr. H. E. Yarrow (chairman) presiding. In presenting the report and accounts the chairman said that during the past year the adoption of Yarrow boilers for both marine and land installations continued to make satisfactory progress. The Cunard Company had decided to adopt them in its new Atlantic liner, and they were now engaged in preparing the boiler designs. The boiler department would be fully occupied for some months to come, and the work in hand included a number of boilers for the mercantile marine and an order recently received from the London County Council for ten high-pressure Yarrow boilers for the Greenwich power station. It was considered desirable to take an interest in a small shipyard in Kralijevica, Jugo-Slavia, and the directors were of opinion that this investment should be beneficial to the company, and be the means of obtaining a certain amount of work for Scotstoun. The report and accounts were adopted.

Venezuela Telephone & Electrical Appliances Co., Ltd.

This company's report was abstracted in our last issue and the annual meeting was held on December 19th, Sir Alexander Rogers (chairman) presiding. In presenting the report and accounts the chairman, after referring with regret to the death of Mr. C. L. Reed, a director, said a valuation of the company's plant and properties had been made by a leading firm of qualified telephone property valuers, and it showed that the physical assets were of greater worth than the figures in the balance sheet. It had been thought that when the conversion of the Caracas exchange to automatic operation had been completed, which it now was, some additional writing down of obsolete plant might be necessary. The valuation showed, however, that the existing reserves were real and on the generous side. In August, 1929, they purchased the telephone undertaking of Maracaibo. He thought the purchase would prove advantageous, but the whole system had been technically overhauled and they were putting it on a sound basis for future expansion. The exchange at Maracay had been converted from manual to automatic, and work was well advanced on similar conversions at Puerto Cabello and Valencia. Automatics would also be installed in the near future at La Guaya, Sabana Grande, and Dos Caminos. At June 30th last the company's subscribers numbered 10,505, an increase during the year of 1,040, or approximately 11 per cent. In September last the company's property was transferred to a local company—the Cia. Anonima Nacional Telefonos de Venezuela—in exchange for shares. In consequence of these important transactions and expansion which had been carried out during the past 18 months, the directors were giving detailed consideration to the constitution of the company, the capital and loan account, which latter at the present time was in the neighbourhood of £400,000, and the local organisation. It was hoped that very shortly plans would be put before shareholders, which would put the company in a position to undertake further development of its national telephone business in Venezuela. The report and accounts were adopted.

Auto Electric Devices, Ltd.

The second report states that the self-winding motor, for the exploitation of which the company was principally formed, has not proved successful as a commercial proposition of general utility. The net loss for the year to September 30th was £9,260, and after deducting £280 brought in, a debit balance of £8,980 is carried forward. The board has turned its attention to the production of certain specialised radio components.

Adelaide Electric Supply Co., Ltd.

The gross revenue for the year ended August 31st was £834,022, compared with £839,156 for the previous year. Expenses were £389,809, leaving a net revenue of £444,213, against £450,724. After paying preference dividends, 12 per cent. on ordinary stock, and other allocations, there is a deficiency of £5,530. Electricity sold during the year totalled 60,978,785 kWh, against 65,407,816 kWh in the previous year. The area of the districts covered by the company's operations is 3,314 sq. miles.

Notting Hill Electric Lighting Co., Ltd.

The *Financial News* reports that an issue of £150,000 5 per cent. redeemable debentures is being made by the company at 101 per cent. A full half-year's interest will be paid on June 30th next. The stock is to be repaid by means of an annual cumulative sinking fund of 1 per cent. per annum, commencing in 1931, and operating by purchases at or below 103 per cent., or by annual drawings at that level. The holders of the £64,000 4 per cent. debentures outstanding have been offered the right to convert their holdings into 5 per cent. redeemable stock. The terms of conversion enable each holder of a £100 debenture, on surrendering that debenture, together with a cash payment of 10s., to receive in exchange £100 of the new stock at £101, less a special discount of ¼ per cent. In addition, he will receive interest on the 4 per cent. debenture from October 1st to December 31st, 1930, inclusive. Holders not electing to convert will be repaid at par out of the proceeds of the present issue on August 26th next.

London and Home Counties J.E.A.

On Friday last week the London and Home Counties Joint Electricity Authority offered for subscription £1,000,000 of 4½ per cent. stock at £95 10s. per cent. The list was to close on or before Monday last. The Authority is empowered by its Order of 1925 to borrow up to £7,000,000; of this amount the Electricity Commissioners have sanctioned £1,067,105. The proceeds of the issue will be applied towards the purchase of the following electricity undertakings:—The undertaking in Twickenham, Teddington, Hampton and Hampton Wick of the Twickenham and Teddington Electric Supply Co., Ltd.; the Surbiton and Chessington undertaking of Callender's Cable and Construction Co., Ltd.; the undertaking in Leatherhead and neighbouring parishes of the Leatherhead and District Electricity Co., Ltd.; and the undertaking in Dorking and neighbouring parishes of Edmundsons' Electricity Corporation, Ltd. The prospectus set out the constitution and powers of the Joint Authority at some length. The stock is to be repaid at par on August 1st, 1925, but the Authority may redeem the whole or part of the issue at par on or after August 1st, 1955.

Victoria Falls & Transvaal Power Co., Ltd.

The directors have declared the following dividends: Preference shares, 3 per cent. for the half-year ending December 31st, and a further dividend of 3 per cent. in respect of the participating rights for the year. Ordinary shares, an interim dividend of 3 per cent. Similar payments were announced in December last year.

British Columbia Telephone Co., Ltd.

This company is making an issue of $7,500,000 of 5 per cent. first mortgage gold bonds, part of which is to be offered in London at 95¼ per cent. The proceeds are to be employed in the redemption of the outstanding debentures totalling about £900,000 and in the extension and improvement of the company's business.

British Thomson-Houston Co., Ltd.

The directors have decided that the dates for payments of future dividends on the 7 per cent. cumulative preference shares will be June 30th and December 31st in future instead of June 15th and December 15th as heretofore.

Yorkshire (West Riding) Electric Tramways Co., Ltd.

A final dividend is announced of 3 per cent. on the 6 per cent. cumulative preference shares. No dividend has been paid on the ordinary shares since 1925.

Hydro-Electric Securities Corporation.

A supplementary dividend of 7.2496 cents per share has been declared on the 5 per cent. class "B" cumulative participating preferred $10 shares, making a total dividend of approximately 5.72 cents on these shares.

International Hydro-Electric System.

A quarterly dividend of 87½ cents per share has been declared on the preferred stock convertible $3½ series. A stock dividend of one-fiftieth of a share is also announced on the class "A" stock held, the option being offered of accepting cash at the rate of 50 cents per share in lieu of stock.

Woking Electric Supply Co., Ltd.

It is reported that the recent issue of 25,000 7 per cent. "B" cumulative preference shares of £1 each at £1 3s. 6d. per share, and 25,000 10 per cent. "C" cumulative preference shares of £1 each at £1 12s. 6d. has been fully subscribed.

Montreal Light, Heat & Power Consolidated.

A dividend has been declared of $0.38 per share on the common shares for the quarter ending December 31st.

Parkinson & Cowan, Ltd.

The directors announce an interim dividend of 2½ per cent. on the old shares (same) and of a like proportionate amount (equal to 3.13d. per share) on the new shares issued in July last.

W. & T. Avery, Ltd.

An interim dividend of 5 per cent. on the ordinary shares (same) is announced.

Telephone Rentals, Ltd.

An interim dividend is announced of 2½ per cent., less tax (same), payable January 14th.

Dutch Company.

The N.V. Metaaldraadlampenfabriek Volt, of Tilburg, reports a profit of 412,000 fl. for 1929 as compared with 457,000 fl. in the previous year. With the exception of 6,730 fl. the whole of the profit has been applied to extra provision for depreciation.

Stocks and Shares.

MONDAY EVENING.

THE usual extra demand for money that occurs at this time of the year is responsible for a slight weakening of prices amongst the purely gilt-edged stocks. With business quiet as a whole, and no particular reason for anticipating an increase in Stock Exchange activity at the present side of the New Year, the tendency is rather for prices to ease off. Dealings are now for the settlement which ends on January 8th, but the fact that the payment will not have to be made for purchases until the first week in the New Year has done nothing to encourage an accession of buying.

New Issues.

The principal feature of interest amongst electricity stocks and shares during the past week has been the issue of £1,000,000 London & Home Counties Joint Electricity 4½ per cent. stock, 1955-1975, at 95½. The stock bears a strong

resemblance to the Central Electricity Board 4½ per cent. stock, 1951-1973, which was issued at 95 about a month ago, and for which there was a notable rush on the part of the investor and the stag. The latter issue came at a time when appetite was quick for all new stocks, whereas the latest comer arrived when this thirst for new stock had undergone something of a reaction. The consequence is seen in the expectation that subscribers will receive allotment in full, and that the price will start at a small discount. The Central Electricity 4½ per cent. stock has gone back to ⅛ discount, that is to say, to 94⅞. G.E.C. new debenture stock at 2¾ premium is a little easier. Edmundsons' debenture at 98 is quoted ex dividend. Of the Home Railway stocks, there are on offer £10,000 each of City & South London and London Electric 4½ per cent. second debenture stocks, 1942-1972, at 100¼, these being T.F.A. securities, paying practically 4½ per cent. on the money.

Electricity Supply.

The tendency of ordinary shares in the Home Electricity supply list has been to lower levels. There are falls in London Electrics, and in a fair number of provincial companies' shares. Clyde Valleys at 34s. 6d. are 1s. 9d. lower. Bournemouth & Poole have given way to 3 1/16, Lancashires to 25s. Egham & Staines at 33s. are a shilling down. Richmond (Surrey) shares remain hard at 42s. 6d. Outside this group, British Light and Power shares at 12s. show a loss of 1s. There is an active demand for preference shares, a reflection of which is shown in a rise of 1s. to 24s. 6d. in City of London sixes, while Notting Hill 6 per cent. preference are practically 10s. higher at 11¼ ex dividend. Victoria Falls remain at 58s. 9d., unaffected by the dividend announcement of an interim payment of 3 per cent. on the ordinary shares, the same as that of a year ago. The preference receive their usual 3 per cent., together with a further similar amount in respect of their participating rights.

Cables and Wireless.

Cables & Wireless "B" ordinary stock strengthened to 12½, showing an increase of 30s., the other two stocks remaining unchanged at 70½ for the preference and 22½ for the "A" ordinary. Globe ordinary are quoted ex dividend at 13, the payment of 5s. net being perhaps the last of that particular amount which the shares will receive until trade improves. The preference, at 10¾, have recovered the deducted dividend. Venezuela Telephones are a little better, the meeting last week producing a hopeful speech from Sir Alexander Roger, the chairman, in which he referred to plans for further development of the business to the advantage both of the public and shareholders. There is a hint that the capital of the company may be re-arranged. The "A" ordinary shares have risen to 20s. Marconi Marines dipped to 37s. 6d., but recovered to 38s. 9d.

Dollar Stocks.

Heavy falls in New York prices, and an approach of the financial position to a state of semi-panic, have been succeeded by calmer considerations, and a rally from the lowest prices recently touched. The industrial and utility shares suffered heavily, and were, naturally, amongst the first to rally after the crisis was overpast. Such shares as Hydro-Electrics and Brazilian Tractions were thrown overboard regardless of anything but the necessity for effecting a sale at what prices the shares would fetch. Now, however, a more sensible view is being taken of the outlook, and prices, as already mentioned, have recovered from the worst. Brazilian tractions at 22 are half a point up. Shawinigan Water at 52 have recovered the modest dividend deducted last week. Pennsylvania Water at 53½ xd show no change. Power Corporation of Canada at 55 are slightly lower than they were this time last week. Consolidated Gas and Electric of Baltimore at 82½ are ex 90 cents. Mexico Tramway shares remain at 10½; the 50-year bonds are lower at 20¼. American Telephones at 184 and Internationals at 24½ have hardened after their recent slump.

Manufacturing and Equipment.

The new 5 per cent. stock issued by the British Aluminium Company has gone back to 2¾ discount. The ordinary shares at 30s. 9d. are 6d. lower. Associated Electrical Industries weakened to 20s. 6d., on account of the New York conditions, while G.E.C. ordinary recovered to 43s. 9d. The National Electric Construction Company has issued a notice to the effect that negotiations are taking place which render it undesirable that shareholders should part from their interests until they received further details from the company. Philips' Incandescent Lamps at 1⅞ are 1/16 down. In the iron and steel market, Babocks have been weak at 47s. 6d., but the price recovered to 49s. 6d. on a little support from the provinces. The rubber market is dormant, the price of the raw material moving within the narrow limits of 4¼d. to 4¾d. per lb.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Approx. Dividend. 1928.	1929.	Price Dec. 22 1930.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	8 1/16	—1/16	4 17 10
Brompton Ordinary	1	8½	8½	27/6	—	5 1 10
Charing Cross Ordinary ...	1	8½	8½	29/-	—	4 16 7
do. do. 4½% Pref.	1	4½	4½	18/-	—	5 0 0
Chelsea	1	8½	8½	27/6	—	5 1 10
City of London	1	10	10	36/3	—	5 10 3
do. do. 6% Pref....	1	6	6	24/6	+1/-	4 18 0
Clyde Valley	1	8	8	34/6	—1/9	4 12 9
County of London	1	7	10	47/6	—⅛	4 4 2
do. do. 6% Pref....	1	6	6	24/-xd	—	4 18 0
Edmundsons' 7% Pref. ...	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation ...	1	11	11	48/9	—	4 10 0
Kensington Ordinary ...	1	8	8	27/6	—	5 1 10
Lancs. Light and Power ...	1	7½	7	25/-	—6d.	5 12 0
London Electric	1	8½	9	32/6	—6d.	5 10 9
Metropolitan	1	9	10	42/-	—6d.	4 15 3
do. 4½% Pref. ...	1	4½	4½	18/-xd	—	5 0 0
Midland Counties	1	6½	7	28/6	—	4 18 3
Mid. Elec. Power	1	15	8	31/3	—	5 2 5
Newcastle-on-Tyne Ordinary	1	6	6	24/6	—	4 18 0
do. 7% Pref. ...	1	7	7	27/6	—	5 1 10
Notting Hill 6% Pref. ...	10	6	6	11¼xd	+½	5 6 8
North Met. Elec. 6% Pref....	1	6	6	24/-	+6d.	5 0 0
St. James' and Pall Mall ...	1	8	8	28/-	—	5 0 0
Scottish Power	1	8	8	29/6	—6d.	5 8 6
South London	1	8½	8½	27/-	—	5 3 8
Urban Ordinary	1	7	7	25/6	—	4 15 0
Westminster Ordinary	1	8½	8½	29/-	—	4 16 7
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	25/6	—	5 17 8
Yorkshire Elec.	1	8	8	34/6	—	4 12 9

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	79	—	5 0 9
Metropolitan	,,	8½	4	68½	—1	5 16 10
do. District ...	,,	4	5	77	—	6 9 10
Underground Electric	£1	7	8	24/6	—	6 10 8
do. do. Income ...	Bonds	6	6	104	—	5 15 5

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	103½	—	5 16 7
do. Def.	,,	1½	1½	26½	—	5 14 5
Automatic Telephone	1	10	12½	37/6	+⅛	6 13 4
Cables & Wireless 5½ Pref.... ...	Stock	—	5½	70½	—	7 16 0
do. A 7½ Ord. ...	,,	—	—	22½	—	... ...
do. B Ord.	,	—	—	12½	+1½	... ...
Globe Tel. and T. Ord.	10	10	10	13xd	—½	7 13 10
do. do. Pref.	10	6	6	10¾xd	+⅛	5 11 7
Great Northern Tel.	10	20	20	30	—	6 13 4
Marconi-Marine	1	12½	15	38/9	—	7 15 0
Oriental Telephone Ord.	1	12	12	23	—	*5 1 1

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	1⅜	—	... ...
do. do. 2nd Pref. ...	5	6	6	17/6	—	... ...
do. do. 5% Deb. ...	Stock	5	5	52½	—	9 10 6
British Electric Traction Def. Ord.	,,	5	5	1325	—75	... ...
do. do. Pref. Ord.	,,	8	8	131½	+1	6 1 6
Brazil Traction	100	7	8	22	+½	... ...
Brit. Columbia Elec. Rly. Pcs. ...	Stock	5	5	96½	—	5 3 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	11/6	—	... ...
London United Tram Deb. ...	Stock	4	4	53½xd	+½	7 9 10
Mexico Trams, 5% Bonds	—	5	5	62	—	8 1 4
Mexican Light Common	100	Nil	Nil	42½	—2½	... ...
do. 7% Pref.	100	7	7	64½	—3½	10 17 0
do. 1st Bonds	—	5	5	79	+1	6 6 7
Victoria Falls Ord.	1	15	15	58/9	—	5 2 0
Yorkshire (West Riding)		Nil	Nil	5/6	—	... ...

MANUFACTURING COMPANIES.

Assoc. Elec. Ord.	1	6	6	20/6	6d.	5 17 1
Babcock & Wilcox	1	13	15	49/6	+9d.	*6 1 0
British Aluminium Ord.	1	10	10	30/9	—6d.	6 10 0
British Insulated Ord.	1	15	15	8½	—	4 12 4
Brush Ord.	Stock	10	10	105	—	9 10 6
Callenders	1	15	15	8¼	—	4 16 0
do. 6½% Pref.	1	6½	6½	25/-xd	+6d.	5 4 0
Crompton Parkinson Ord.	5/-	—	30	21/3	—	7 1 2
do. 8% Pref.	1	8	8	26/3	—	6 2 0
Edison-Swan 1st. Pref.	1	7½	7½	28/9	—	6 6 4
do. 5% Deb.	Stock	5	5	92½xd	—	5 8 1
Electric Construction	1	6½	6	12/-	—	8 6 8
Enfield Cable Ord.	1	20	25	4⅛	—	5 16 8
English Electric	1	Nil	Nil	10/-	—⅛	... ...
do. do. Pref.	1	8	Nil	10/-	—	... ...
Ferranti Pref.	1	7	7	21/-	—	6 13 4
G.E.C. Pref.	1	6½	6½	23/6	—	5 2 0
do. Ord.	1	10	14	43/9	+⅛	6 7 9
Henley	1	25	30	5½	—	5 1 0
do. 4½% Pref.	5	4½	4½	4½	—	5 5 0
India-Rubber	1	Nil	Nil	6/8	—	... ...
Johnson & Phillips	1	10	10	36/9	—	5 8 10
Siemens Ord.	1	7½	7½	1⅛	—	7 1 2
Telegraph Construction	12	10	10	17½	—	*6 18 0

* Dividends paid free of Income Tax.

Our Foreign Electrical Trade.

Electrical Exports and Imports during November.

GREAT Britain's overseas electrical trade, both outward and inward, experienced a considerable decline during November. The Board of Trade returns for the month show that the total value of electrical exports was £1,367,399, but although this was £181,879 below the September figure, it was greater than in June and August this year. The decrease as compared with the previous month was general in character, and only three items showed increases. Unenumerated goods and machinery fell to the greatest extent and accounted for about half the decline in the total. Submarine telegraph and telephone cable exports were lower by over £42,000, and insulated wires and cables, and non-submarine telegraph and telephone cables were also responsible for £23,000 of the decrease. A very substantial increase occurred in the case of traction motors, but it was counterbalanced by falls in the other two items, resulting in a net decline of £12,764 in the machinery exports. As compared with November, 1929, there was only one increase—that of £24,148 in the case of railway and tramway motors. The net decline was about £460,000. The most serious decrease occurred in exports of insulated wires and cables (£197,000); unenumerated goods were £105,000 down; while there was a net decline of £49,000 in the machinery section. The fall in the month's total reduced the exports for the first eleven months of the year to about £900,000 below the corresponding figure for 1929.

As regards imports, the decline was greater absolutely as compared with October, and proportionally as compared with November last year. The main cause of this was a smaller importation of electrical machinery, although decreased imports of batteries and accumulators were almost equally responsible. Other items in which substantial falls occurred were telegraph and telephone instruments and apparatus and insulated wires and cables. In spite of the reduction of imports in November, the total for the first eleven months of the year is still half-a-million above that for the corresponding period of last year.

Re-exports, which have been on an unprecedentedly large scale this year, again showed an advance, and the total for the first eleven months showed an increase of £274,514, which helped to compensate for the lower exports of British electrical goods, apparatus and machinery.

It will be seen from the inset table that there was a fall in the price per ton of exported machinery from £162 in November, 1929, to £153 last month. This appears to have been due mainly to the exports to India, which decreased considerably in unit value. On the whole, foreign countries were better customers than the Dominions in November. Large decreases in the cases of Australia, India, and Canada were compensated for to some extent by rises in the amounts taken by South America, Europe, and Japan.

Electrical Machinery Exports.

Destination.	Quantities. Nov., 1929. Tons.	Quantities. Nov., 1930. Tons.	Quantities. Inc. or dec. Tons.	Values. Nov., 1929. £	Values. Nov., 1930. £	Values. Inc. or dec. £
Europe	419	566	+147	95,962	97,054	+ 1,092
Japan	84	105	+ 21	15,344	16,154	+ 810
South America ...	342	802	+460	48,936	128,699	+79,763
South Africa ...	254	462	+208	38,459	48,277	+ 9,818
British India ...	481	437	− 44	92,370	65,693	−26,677
Australia	586	183	−403	89,012	30,380	−58,632
New Zealand ...	204	193	− 11	30,809	31,454	+ 645
Canada	367	202	−165	48,160	27,440	−20,720
Other countries ...	812	476	−336	115,063	79,826	−35,237
Total ...	3,549	3,426	−123	£574,115	£524,977	−£49,138

	Exports. Electrical exports for Nov., 1930.	Exports. Inc. or dec. as compared with Oct., 1930.	Exports. Inc. or dec. as compared with Nov., 1929.	Imports. Electrical imports for Nov., 1930.	Imports. Inc. or dec. as compared with Oct., 1930.	Imports. Inc. or dec. as compared with Nov., 1929.	Re-Exports. Electrical re-exports for Nov., 1930.	Re-Exports. Inc. or dec. as compared with Oct., 1930.	Re-Exports. Inc. or dec as compared with Nov., 1929.
Electrical goods and apparatus (unenumerated)	£230,349	−£43,533	−£105,372	£183,556	− £8,881	− £29,521	£10,195	− £671	+ £236
Insulated wires and cables ...	177,470	− 23,685	− 197,132	60,924	− 21,782	− 29,678	1,017	+ 453	− 262
Glow lamps	36,523	− 4,242	− 30,174	49,368	− 16,077	− 11,382	435	− 366	− 866
Arc lamps and parts	844	− 1,118	− 3,369	4,568	− 969	+ 2,243	14	− 126	—
Batteries and accumulators ...	60,673	− 8,874	− 35,459	77,381	− 51,638	− 54,679	2,588	+ 2,070	+ 1,935
Meters and instruments ...	31,084	− 11,945	− 2,372	66,605	− 8,946	+ 13,306	8,926	− 1,391	+ 8,229
Carbons	704	+ 173	− 1,575	16,931	+ 1,765	+ 6,397	74	+ 2	− 3
Switchboards (not telegraph or telephone)	7,008	− 6,501	− 387	227	+ 167	+ 215	4	+ 4	− 4
Electrical Machinery—									
Electrical machinery (unenumerated)	297,580	− 50,563	− 37,640	106,158	− 53,075	− 55,032	14,596	+ 4,737	+ 1,206
Railway and tramway motors	43,310	+ 34,178	+ 24,148	—	—	—	—	—	—
Other motors and generators...	184,087	− 26,379	− 35,646	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	50,737	− 11,012	− 8,558	2,553	+ 1,219	+ 254	53	+ 53	+ 53
Submarine telegraph and telephone cable	12,952	− 42,190	− 17,085	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	234,078	+ 13,812	− 9,028	130,927	− 36,512	− 40,597	7,196	+ 715	− 3,957
Totals...	£1,367,399	−£181,879	−£459,649	£699,198	−£194,679	−£198,474	£46,098	+£5,480	+ £6,567
Increase or decrease for first eleven months of 1930			Exports −£899,335			Imports +£498,922			Re-Exports +£274,514

Supervisory Control of Sub-stations.

A description of the system developed by the Metropolitan-Vickers Electrical Co., Ltd., and the Automatic Telephone Manufacturing Co., Ltd., as applied to the Central Argentine Railway.

THE supervisory control of the sub-stations on the recently-extended electrified lines of the Central Argentine Railway is an interesting example of modern practice in power system organisation. The supervisory apparatus is applied to the complete control of five unattended sub-stations with rotary-convertor plant totalling 20,000-kW capacity, together with two track-sectioning cabins. The system also provides telephonic communication with four manually operated sub-stations having rotary-convertor plant totalling 17,000 kW, and a dummy layout of indicating gear for these sub-stations is included on a mimic diagram board at the control office.

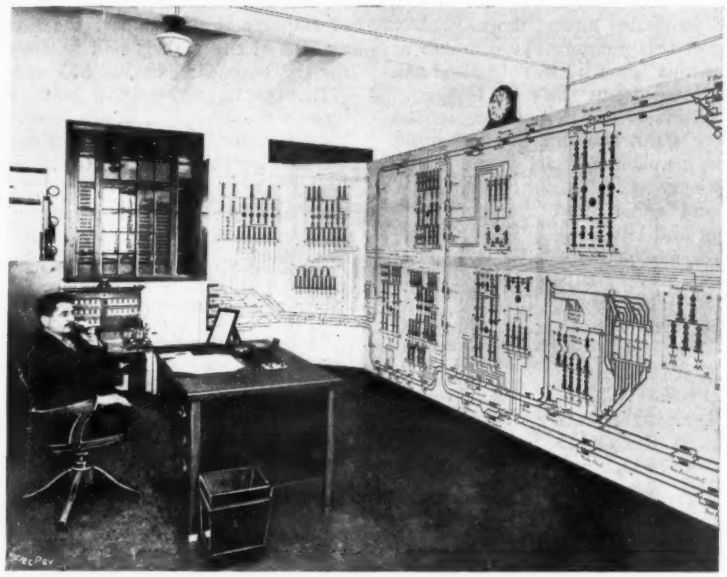


Fig. 1.—In the Central Supervisory Control Room at Olivos.

As shown in fig. 5, the electrified system of the railway comprises three suburban lines from the Buenos Aires terminal station at Retiro. The Tigre West line was electrified in 1916, with very satisfactory results; the number of passengers carried per year on this line progressively increased from 5½ millions in 1915, the last year of steam operation, to 17½ millions in 1927, and this large increase of traffic was successfully handled without necessity for track layout modifications or other works. Following on these successful results the other two suburban lines have now been electrified. The operation is on the third-rail system at 800 V d.c., and the supply to the sub-stations is at 20,000 volts, 3-phase, 25 cycles, from the company's power station at Canal San Fernando. This installation is linked up with the power station which serves the Buenos Aires Western Railway.

The extensions of the electrification have necessitated important additions to the power plant and rolling stock. The generating plant in the San Fernando power station has been increased by the addition of three 6,000-kW turbo-alternator sets, bringing the total plant capacity of station up to 30,000 kW, and the sub-station equipment is being increased by the addition of fourteen 2,000-kW rotary-convertor sets, ten of which are being installed in five new unattended sub-stations, and four as additions in the existing manually operated sub-stations. The new rolling stock comprises 111 motor coaches, 15 driving trailers and 95 ordinary trailers. The whole of the new electrical equipment for the rolling stock and the sub-stations, including the supervisory control apparatus, together with additional transformers and switchgear for the 20,000-volt transmission system, is being supplied by the Metropolitan-Vickers Electrical Co., Ltd. The new arrangement of the sub-stations and their plant is as follows:—Attended sub-stations, San Fernando (5,000 kW), Olivos (5,000 kW), Palermo (5,000 kW), and Retiro (2,000 kW); unattended sub-stations, San Isidro C. (6,000 kW), Nunez (4,000 kW), Coghlan (4,000 kW), San Martin (4,000 kW), and Kilometre 24 (2,000 kW). There are also two unattended track-sectioning cabins at Florida and San Isidro on the Tigre East line included in the supervisory-control system.

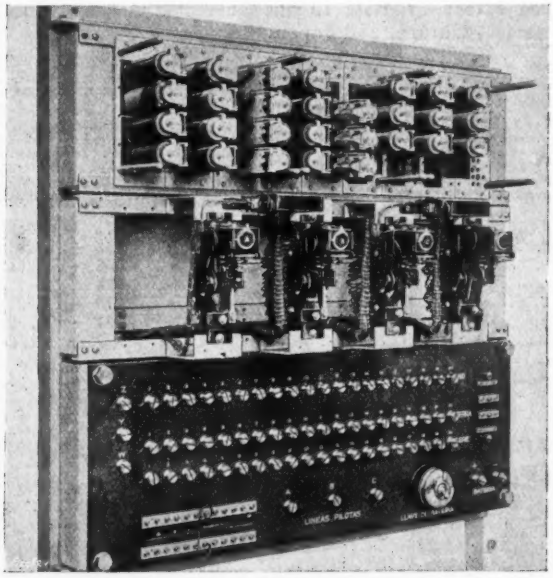


Fig. 2.—A Typical Sub-station Cabinet; cover removed.

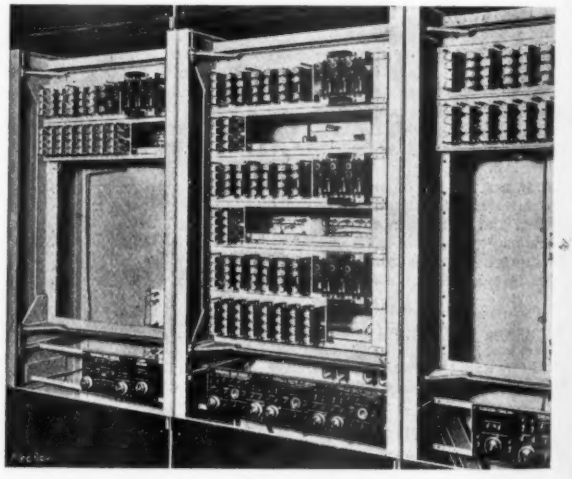


Fig. 3.—Part of the Control Board Operating Equipment.

Typical views of the sub-station equipment are given in figs. 4 and 6. Fig. 4 shows a group of metal-clad circuit breakers on the 20,000-volt system; three of the units control incoming and interconnecting feeders, two serve for the supply to the rotary-convertor transformers, and one governs a trans-

former for the station lighting and power supply. In the middle of the group is a bus-bar coupling unit.

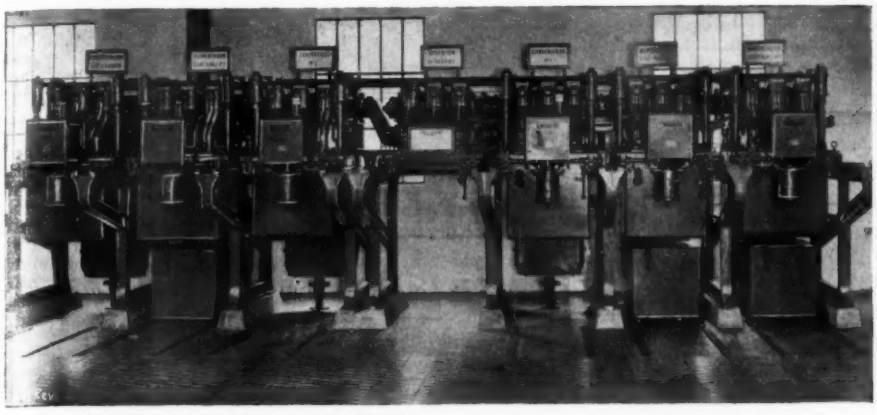


Fig. 4.—20,000-V Switchgear in Nunez Sub-station.

In fig. 6 are depicted the two 2,000-kW rotary convertors in the Nunez sub-station. The machines are arranged for motor starting with self-synchronising on the M.V. system, and their design incorporates special features to enable them to withstand short-circuits without flash-over. The commutators are of the same diameter as the armatures, and fans and enclosing covers are fitted which maintain a strong axial draught outward over the commutator surface, so that any vapour generated under short-circuit conditions is rapidly dissipated. All metal parts near the commutator are insulated with arc-resisting material to prevent flashing over to ground. On test, even with d.c. current values above 20,000 A, in no case did a machine flash over. The tests were carried out before the machines were dispatched. The panels on the left, fig. 6, carry the control equipment for the 20,000-volt switchgear. Those on the right carry the automatic starting equipment for the rotary convertors.

The whole of the sub-station and track-sectioning equipment is controlled from a central office situated at Olivos. In the case of the five unattended sub-stations and track-sectioning cabins the operations are directly initiated by the load dispatcher, carried out by the supervisory control equipment, and automatically indicated on the mimic-diagram control board. The dispatcher transmits operating instructions by telephone to the operators in the attended sub-stations, and receives by the same means confirmation that the required operations have been carried out. He then records the operations on the appropriate section of the mimic diagram, so that complete indication of the connections throughout the system is maintained. Fig. 1 is a view in the control office. The control board is 29 feet long and 8 feet high, and has nine panels, seven only of which are shown. The three traction routes are each represented by a double line starting from the Retiro terminal-station panel at the extreme left of the board, and the 20,000-volt supply lines from the power station at Canal San Fernando, panel No. 9, not shown, are depicted by the fine lines passing horizontally across the panels at about mid-height and terminating at the top of No. 1 panel on the left.

Corresponding with its geographical location with respect to the track, each sub-station and track-sectioning cabin is represented by a compact group of signal lamps and supervisory control apparatus, a dummy layout for hand setting being provided in the case of those sub-stations which are manually operated. For each circuit breaker the control board carries a pair of red and green lamps which indicate continuously whether the circuit breaker is closed or open. In the case of the unattended sub-stations there is provided beside these lamps a two-way selector key which initiates the selection of that circuit breaker for operation by the supervisory control gear. An indicator lamp is installed beside the key to signal the completion of the selecting operation.

The required opening or closing of the circuit breaker is then put into effect by means of an operating push-button located in the middle of the group. The control panel equipment for each sub-station includes also a checking key for confirming at any time the "on" and "off" position indications. The equipment also includes a signal lamp which, together with an alarm bell, calls attention to any circuit-breaker opening which may be initiated by the automatic equipment. When this occurs the particular circuit breaker which has opened is indicated by the intermittent lighting of the green lamp associated with it, the indications being maintained until the control room attendant resets them to normal by means of a switch provided for this purpose.

The operating equipment of the control board is illustrated in fig. 3, which shows the back of the centre panel, No. 5, representing the San Isidro C automatic sub-station and two track-sectioning cabins. The stepper switches and relays of each panel are mounted on a hinged gate frame which can be swung out for inspection or alteration of the connections. The apparatus installed in the sub-stations as illustrated in fig. 2, which shows a typical cabinet with its cover removed. The units at the top are relays, in the middle a four stepper switch, and below these are three rows of terminals for the indicator circuits and the opening and closing circuits of the circuit breakers. Connections and a switch for the battery are at the bottom. Each sub-station under supervisory control is connected to the control room by two pilot wires, one for selecting the circuit and one for operating the breaker.

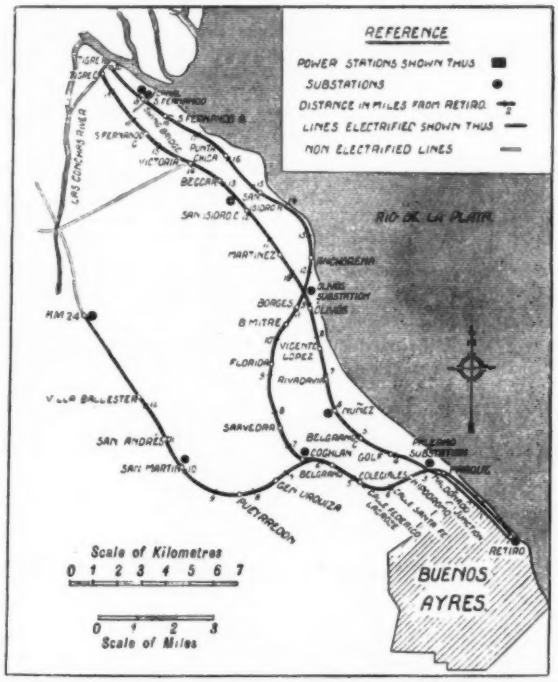


Fig. 5.—Central Argentine Railway Suburban Lines.

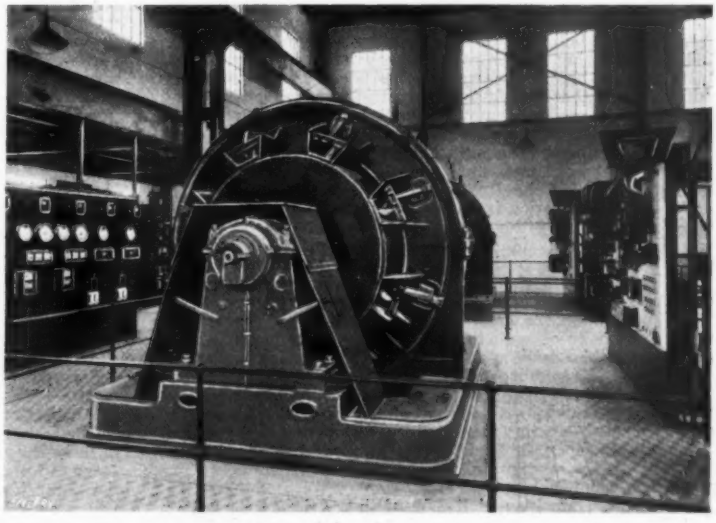


Fig. 6.—Two 2,000-kW Rotary Convertors in Nunez Sub-station.

Industrial Waste.

The recovery and profitable utilisation of waste materials and process by-products.

(*Extracts from papers read at the* DECEMBER CONFERENCE *of the* INSTITUTION OF CHEMICAL ENGINEERS.)

THERE is a tendency in the reorganisation of our manufacturing industries to regard rationalisation as covering only changes in management and in the number of works brought under one control; when this has been completed the investor expects an immediate improvement in the efficiency and profits of the particular branch of manufacture to which rationalisation has been applied, and is disappointed when improvement fails to materialise.

Mr. John B. C. Kershaw, F.I.C., points out in his paper that this view is a mistaken one, for amalgamations alone can achieve very little, unless accompanied by many other fundamental reforms. Reduced costs of production can be attained only by the elimination of all waste, whether of time, labour, or materials, and not until all engaged in manufacturing industry, both masters and men, have fully accepted this principle and have put it into practice can we expect to see any real improvement in our external trade, or in our ability to compete in the open markets of the world.

Domestic Refuse.—Incineration is the proper method of dealing with the residue from domestic and trade refuse remaining after all saleable materials have been extracted from it. Incineration demands a proper destructor for its practice, and the requests of sanitary inspectors and medical officers of health that all householders should burn their own refuse is a mistaken one, and is likely to lead to much unnecessary pollution of the atmosphere by those who attempt it.

The advantages of a properly designed destructor are that the clinker produced by fusion of the ash finds a ready sale for road construction and repairs, and the surplus heat produced by the combustion of the refuse can be used for generating electricity, or for some other purpose. The Govan refuse power plant at Glasgow, in the year ended May 31st, 1929, produced a revenue of £16,322 by the sale of the electricity generated from the surplus heat of the destructors, and is now connected up as a stand-by for the grid system of electricity supply, but one word of warning is necessary. Over £600,000 has been expended upon the Govan works, and the payment of interest and sinking-fund on this huge outlay absorbs more than the whole of the revenue at the present time. The monetary aspect of waste recovery has been somewhat neglected in the past by those authorities which have devoted most attention to salvage, and the tendency to spend excessive capital upon unnecessarily elaborate salvage plant requires checking.

Power-station Fumes.—The campaign for reducing smoke and thereby obtaining a purer atmosphere is not yet over. The increasing use of electricity is, undoubtedly, helping to solve the black-smoke problem, but the increase in the number of large power stations has created a new problem for the chemical engineer. To obtain the cheapest possible electricity for the domestic consumer lengthy underground high-voltage cables should be avoided, and the power station should be in the centre of the area to be supplied. The author considers it is quite possible for the waste gases from any super-power station to be cleansed from the greater portion of their solid and gaseous impurities before discharge into the atmosphere, provided a sufficient supply of water is available for the purpose.

It is generally agreed that the increased amount of ash and grit in waste boiler gases due to the use of pulverised fuel and of dust firing can be reduced very largely by centrifugal dust catchers before the waste gases reach the base of the chimney, and that the finer dust particles which still remain in suspension can be removed by water-sprays placed either in special chambers or in the chimney itself.

The only criticism the author has to make concerning the experimental work and final design and plans which have been prepared for the treatment of the waste gases of the Battersea power station is that much time and expense would have been saved if the engineers who have prepared them had called to their aid at the commencement chemical engineers with experience in the design and operation of gas plant for the heavy-chemical and acid-making industries. It would seem a mistake, also, when such large sums will have to be spent upon the erection and operation of the washing apparatus, not to attempt to recover the sulphur in some more useful form than calcium-sulphate, which is a salt of no value.

Mr. E. B. Busenburg points out that reclaimed rubber can be very readily modified in its handling properties, and that reclaimers have developed a large number of grades for definite purposes, such as the manufacture of pneumatic tires and tubes, rubber shoes and heels, insulated wire, &c. The average consumption has averaged about one pound of reclaimed to two pounds of crude rubber.

Mr. J. W. Hinchley, A.R.S.M., Wh.Sc., F.I.C., considers that the recovery of useful metals from waste materials has almost an ethical claim to consideration. When we learn to regulate our supplies, we shall realise the importance of conserving what we have, and wasting the minimum.

The cost of sorting waste material is a very serious item in the cost of recovery, but it may be avoided entirely in large industrial undertakings by avoiding the mixture of materials in the first instance.

Copper and its Alloys.—Their greater values create more incentive to careful separation or sorting. In the treatment of turnings and cuttings, water and grease are usually removed by heating in a continuous roaster having a travelling chain bed. After the material has cooled the removal of any adventitious iron by a magnetic separator is easy.

In spite of standardisation and careful sorting, melting methods fail to give satisfactory materials for the manufacture of a good bronze owing to the presence of such extraneous metals as lead, antimony, zinc, &c., while metallurgical methods fail to produce pure copper or tin from them. O. Scarpa* has developed an electrolytic process which has been in successful use for several years on the Continent, the energy consumption being 0.665 kilowatt-hours per kilogram of copper deposited. The purity of the copper is 99.97 per cent., and the slimes removed from the bath usually contain about 25 per cent. of tin, 8 per cent. of copper, 7 per cent. of lead, 3 per cent. of zinc, 0.3 per cent. of iron, 0.5 per cent. of antimony, with traces of other substances. The solution of stannate of soda obtained after purification for the removal of zinc, lead, &c., is also treated electrolytically; the tin is deposited on thin tin cathodes, the anodes being of iron. The consumption of energy is 10 kilowatt-hours per kilo. of tin obtained. The residue of slimes is reduced in a reverberatory furnace, and the alloy obtained is retreated electrolytically.

Tin and Iron.—The universal use of tin-plate containers presents important metal-recovery problems; the steel smelter will not handle material containing more than a trace of tin, while the treatment of old tin cans contaminated with paints, oils, varnishes, foods, drugs, &c., presents still further difficulties.

One of the successful processes is electrolytic. Although acid electrolytic processes are known, the usual electrolyte is a 70 per cent. solution of caustic soda heated to 70 deg. C. Iron plates, which are removed every 12 hours or so, form the cathodes, while the scrap tin cuttings, supported in iron cages about 15 in. wide, form the anodes. The tin is deposited as a spongy grey mass, and after being scraped off the iron plates, washed and pressed into small briquettes, is melted and cast into ingots. The de-tinned contents of each iron cage are charged into a hydraulic press and formed into a briquette of convenient size. Any oil, grease, paint, or varnish on the scrap is attacked by the caustic soda, forming a soap which dissolves in the bath, and to some extent preserves the spongy tin from oxidation on its removal from the bath. A great advantage is that the tin is recovered in the metallic state. The energy consumption is about 100 kilowatt-hours per ton of scrap treated.

*(British Pat. 1925/227,125.)

Tales Engineers' Wives Tell.

By ADA THYME.

MY husband is an engineer in charge of the plant in a large factory, and I, his so-called fortunate wife, occasionally cause eyebrows to be lifted and mouths to open in amazement at what my friends call my jaundiced views of life. My eyebrows might have lifted, and my mouth opened too, a few years ago, but those who read may judge.

I was married after a rather brief courtship and certainly did not realise just what a "plant man," and incidentally a plant man's wife, have to put up with. Certainly on several occasions during our courting days, I received telephone or written messages to the effect that "he" could not keep an appointment, owing to a "spot of bother" at the works. On other occasions on taking him gently to task for being a "dull dog" (such as falling asleep in the kinema) I was told that he had been called out to some breakdown during the night. Some of these tales were taken with the proverbial grain of salt, but I had not been married many weeks before I received a taste of what was to occur far too often for my liking. We were going to a dance one night and just as we had got into our "glad rags" the 'phone rang. A dialogue took place and at the end of it my husband turned round to me and said: "Sorry, my dear, I'll have to slip down and see what's the matter. You go on; I'll follow as soon as I can." Me: "No! I'll wait for you; you won't be long, will you?" Hubby: "Oh, no! Only a few minutes." About five hours later, a bitterly-disappointed woman crawled into bed, and when about 4 a.m. a tired, bad-tempered man came home, the only explanation I received was some cryptic remarks about defective relay valves and oil pumps, with observations regarding sanguinary carelessness. My ruined evening was not even mentioned. Oil stains on a dress shirt and a dinner jacket, which I discovered next morning, only added to my "contentment."

I am beginning to think that I could almost qualify for an

engineer's job myself, at all events my knowledge of technical terms is now quite extensive, although I have been "stumped" once or twice. One night Bill was out and the wretched 'phone rang. Our 'phone is connected to the works, so there is rarely the chance of a pleasant surprise for me if I have to answer it. I answered it that night and this is what I heard.

"Is the gaffer in, mum?"—"Not at the moment."

"Will you tell him a toob has gied notice."—"I beg your pardon."

"A toob—a boiler toob! T-U-B-E, toob."—"What has happened to it?"

"It's gied notice."—"I don't understand."

"He will! It's leaking bad."—"Oh, all right! I'll tell him."

That was another night out for him, and there were burns on hands and arms to be dressed when he did come home. Meals are another trial to me, not the preparing of them, but the uncertainty of his appearance at the table. Of course the works has a recognised lunch hour and a recognised time for stopping at night, but my hubby takes no heed of either, and if I mention that a particularly tasty lunch has spoilt through keeping for over an hour, the usual answer is "Sorry, my girl, I was rather busy and forgot it was 'stand easy' time."

It is at week ends and holiday times that he really does see life. That is the time when overhauling and major repairs are effected, and my little girl sometimes says: "It isn't Sunday, mummy, 'cos daddy has gone to work and they do not work on the Lord's Day, do they mummy?"

I suppose this perpetual watch on the machinery which enables thousands of men to earn their livelihood is necessary, and a trust not to be taken lightly, but it does not lead to a gay life or even a social one.

My Bill has a passion for economics, and even at home in the evenings there are calculations to be worked out, or some scheme to be devised that will reduce running costs, or effect some other economies. If it isn't that it is some solemn-looking book, and when I ask what it's all about I get told "Oh, a book out of the works library; I must not get behind the times; one is apt to get into a groove, you know, in a job like mine."

However, sometimes when I pass the works, especially when they are all lighted up in the evening and I hear the hum of the machinery, and think of the thousands who are earning their bread and butter inside them, I feel a thrill of pride, and think that in my small way, by keeping one man healthy and happy, I am doing my bit to help the wheels to go round, and this repays me for the many lonely hours I have spent since I became a "maintenance engineer's mate."

Pacific Coast Developments.

More than half of the new electric power stations in the eleven western states of the U.S.A. will be fuel-burning when the present year's construction programme is complete.

(COMMUNICATED.)

AN important feature of the developments taking place on the Pacific Coast was the setting to work in February last of a second 100,000-kVA, single-unit, steam turbo-altternator at the Long Beach No. 3 station of the Southern California Edison Co., bringing its capacity to 200,000 kVA. The extension will, at the same time, make the aggregate capacity of the stations of this company, which supplies the Los Angeles and Long Beach areas, over 400,000 kW. Steam pressure will be 400 lb. per sq. in. at the throttle. The new set may be seen in the foreground of fig. 3 as it appeared during the final stages of completion. In the background, a similar set installed in 1928 is shown; the latter last year generated no less than 594 million kWh from natural-gas fuel. A view of the boiler house is given in fig. 4. The Pacific Gas and Electric Co. is rebuilding its "A" station in San Francisco. Two new units of 38,000 and 12,000 kW are being installed to operate at a steam pressure of 1,200 lb. per sq. in. Duplicate sets are expected to be ready to run in six months and the three cross-drum boilers will have a total evaporative capacity of 500,000 lb. per hour. The Puget Sound Power and Light Co. recently completed the instalment of a 43,750-kVA turbo-alternator, at a cost of about £1,000,000, in its Shuffleton station at Lake Washington. The total capacity of the complete scheme will be 150,000 kW. A duplicate unit is nearing completion. The steam pressure is 450 lb. per sq. in., and the boilers will be fired with oil and hog fuel (sawdust). The station has been designed for an ultimate capacity of about 250,000 kW. It is connected with Seattle, 32 miles away, by a 110-kV overhead line supported on steel poles.

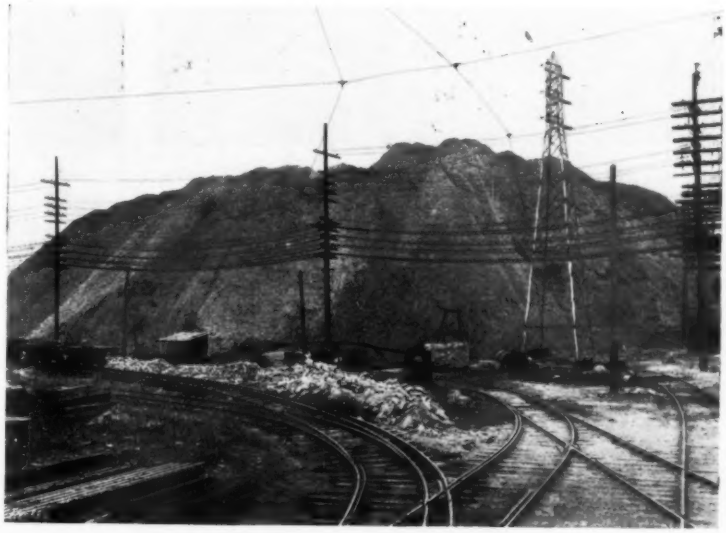


Fig. 2.—Sawdust Fuel Pile at Portland.

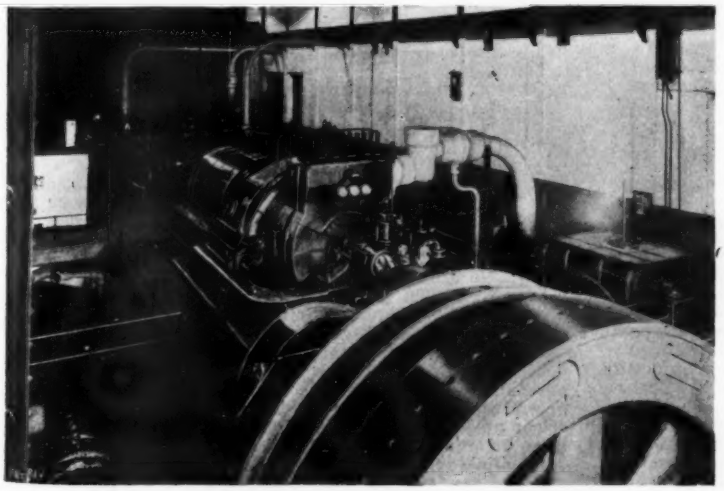


Fig. 1.—Engine Room of Portland "L" Station.

The North-Western Electric Company, some months ago, installed a third unit—of 25,000 kW—at Lincoln power station at Portland Oregon. The total capacity is now 45,000 kW, and the boilers are also fired with hog fuel and oil. The electrical output is transmitted at 66 kV to the city by a 5½-mile transmission line, which, it is of interest to note, is carried on wooden poles.

Another Portland development is station "L" of the Portland Electric Power Co., where hog fuel and oil are again the fuels employed. The main turbo-generators are of 35,000 kW each, and the total station capacity is 77,500 kW. Fig. 1 is a view of

the engine room and fig. 2 of the fuel stack, which is composed of sawdust.

Several smaller installations ranging from 10,000 kW to 35,000 kW have also been laid down to generate electricity by the burning of hog fuel, oil, and natural gas.

The net increase in steam-electric generating capacity over a period of the past six years in the eleven western States amounted to approximately 672,890 kW, or a net increase of

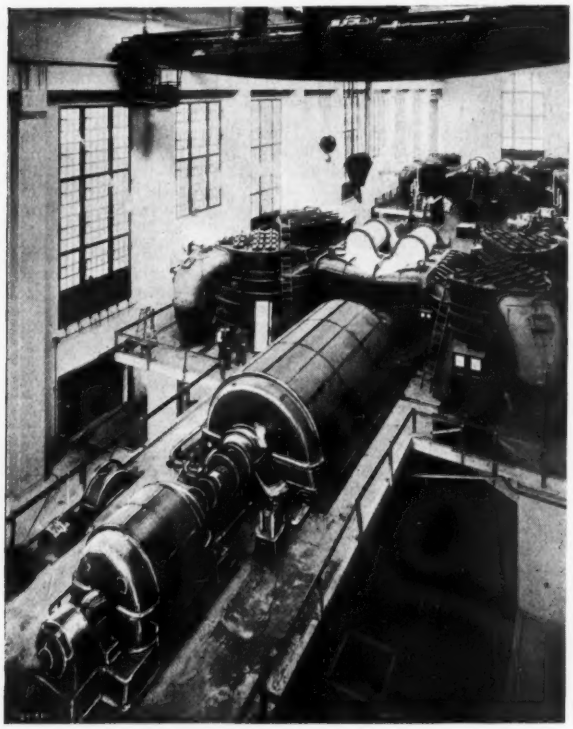


Fig. 3.—100,000-kVA Single-unit Sets.

Fig. 4.—Boiler House at Long Beach Station.

94 per cent. in capacity over the figures in the eleven States at the start of 1924. With the completion of projects under way the close of 1930 will see a steam-plant capacity totalling 1,631,015 kW.

Modern Kinema Design.

Comments on the electrical illumination and acoustic features of typical theatres.

(Extracts from a lecture delivered before the ROYAL INSTITUTE OF BRITISH ARCHITECTS, *London.)*

MR. J. R. LEATHART, F.R.I.B.A., who demonstrated his subject with the aid of a large number of lantern slides, remarked that the modern kinema in all its complexity of planning and equipment had been aptly described as the architecture of pleasure. The outstanding development of the modern kinema was evident in its heating, ventilation, and electrical installations, while the science of acoustics was now realised to be of greater importance than hitherto as a basis upon which the auditorium must be shaped than the selection of the style for the interior decoration.

Experience and research had proved that the volume of an auditorium must be kept within certain defined limits, if excessive reverberation was to be avoided, and as low a figure as 120 to 130 cu. ft. per seat had been suggested as the maximum. The talking film reproduced the primary reverberation that was set up in the recording studio, which was, in turn, augmented by the reverberation set up within the auditorium itself. To reproduce the sound as originally taken it was therefore desirable to eliminate the secondary, or house, reverberation as much as possible, which could be accomplished satisfactorily by reducing the volume to within the limits quoted; by the use of directional loud-speaker horns behind the screen, which could be adjusted to cover all seats; by the use of absorbents in the rear auditorium walls; by thick carpeting on all floors, and heavily upholstered seats. The fan-shaped auditorium, both in plan and section, counteracted to a great extent the tendency to acoustical imperfection, providing that the ratio of the rear auditorium width to the proscenium was not too excessive, and had an additional advantage in that it placed the greatest number of seats at a desirable distance from the screen and the minimum number outside a reasonable angle of vision.

Usually the gallery front was on a level with the loud-speaker horns, and there was a risk of it returning the sound falling upon it in a concentrated form upon the loud-speakers. To avoid this fault the front was better polygonal in plan, with three or more straight facets, and inclined backwards in section. The volume of the auditorium of the new Richmond kinema was somewhat greater than that of the new East Sheen theatre, 170 and 154 cu. ft. per seat, respectively. The "atmospheric" interior decoration governed the high front portion, and contributed to the increase of volume. The reverberation coefficients of the auditorium were: full, 1.5 sec.; one-third full, 2.3 sec.; empty, 3.4 sec. The only absorbent was on the front of the transverse lighting gallery, and the results were particularly satisfactory, as the loud-speakers did not require excessive amplification to carry the sound to the rear seats. The introduction of sound-reinforcing coves at the back of the auditorium contributed to this result.

The increasing tendency for kinemas to function equally as theatres must serve as a warning that too many absorbent surfaces in an auditorium would render the natural human voice and the orchestra somewhat lifeless in effect and create a tendency to flatten the tone thereof. It was therefore imperative that expert acoustical advice should be sought in the initial stages of design, so that the necessary compromise could be effected between the requirements of the theatre and those of the kinema. The safety of the public in places of entertainment must obviously be the first consideration; nevertheless, it had to be admitted that the English regulations considerably impeded the imagination and spacious planning usually to be found in modern Continental work. The provision of adequate accommodation for the mechanical equipment was too often overlooked in the commercial obsession to accommodate the maximum number of seats on a given site.

Mr. Leathart illustrated his observations by the comparison of examples of exteriors and interiors from American, English, and Continental sources, pointing out that the outstanding current tendency was to internationalise decorative forms, *i.e.*, the recognised architectural characteristics of each country were gradually being abandoned. The prevailing habit of English theatre architects of considering the decorative scheme as an afterthought had resulted in waves of fashion of miserable mediocrity. Chronologically, the Kensington kinema and the recently opened New Victoria kinema demonstrated the extreme ends of the gamut of styles. The development of flood lighting in changing colours from concealed sources had enabled the architects of the latter to design a scheme of decoration of imaginative possibility, the emotional effect of colour produced by concealed light being exploited with great effect. At the former the painted architecture was illuminated from visible points, and somewhere in the middle scale between the two was the new Savoy, as there was no fundamental difference between modern theatres and kinemas.

In Eric Mendelsohn's famous Universum, Berlin, finality

in the elimination of decorative motifs and the possibilities of the integral use of light as definite elements in the treatment of the interior were vigorously demonstrated. It was virile and stark, indicative of the passion of Germans for mechanical form. The Capitol, Berlin, was another example of straight-line design, the light coming from concealed sources and making no attempt to pattern itself as a decorative form. The Skandia, Stockholm, had been described as the most beautiful theatre in the world, and it was, therefore, interesting to observe the influence of the atmospheric type of its interior treatment. Rapturous appeals appeared from time to time for a revolution in architectural form modelled on German lines, but there would seem to be more affinity in this country for the traditionalism so exquisitely developed by Asplund in his Skandia theatre than for the stark unemotional work of Mendelsohn. We were, as a race, too humane to tolerate the ruthlessness of Continental modernity in our kinemas.

The Welwyn Theatre, Herts., was an English example of the prevailing breakaway from tradition. Its auditorium shape was based on acoustical considerations and was primarily dictated thereby. The ceiling acted as both a light and sound reflector.

The important aspect of the appearance of a kinema's exterior at nightfall had only comparatively recently been appreciated to its full extent. The necessity for the nocturnal effect of the front could not be too highly emphasised. The usual expedient of throwing light on an elevation from flood lamps on projecting arms was rudimentary, but it had been almost universal in adoption. There were three types of external illumination: first, lamps were part of the structure of the design in which they were interwoven, as in the Titania-Palast, Berlin. In this case, except for the concentrated cornice lighting, the front was not flooded. The effect was obtained by contrasting horizontal illuminating panels with dark wall surfaces. The possibilities of this original treatment were apparent, and pointed to a profitable field of invention in this direction. The second type of night architecture was illustrated by the new Sheen kinema. Upward flooding of wall surfaces from concealed sources was combined with concentrated visible illumination in the cone-shaped urn at the top of the central-bay feature, together with the neon-sign title panel. Three distinct locations of light were arranged for: one at the top of the bay, one at its base, and one in the canopy top. In addition, the canopy soffit was flooded and the light reflected from a "Staybrite" steel surface underneath. The effect of those light surfaces could be accentuated by using colour media from within the building. The third type of illumination was from within the building through decorative windows, or perforated grilles, as in the example of the Piccadilly, Berlin; but the possibilities of conspicuous effort were somewhat restricted by this method.

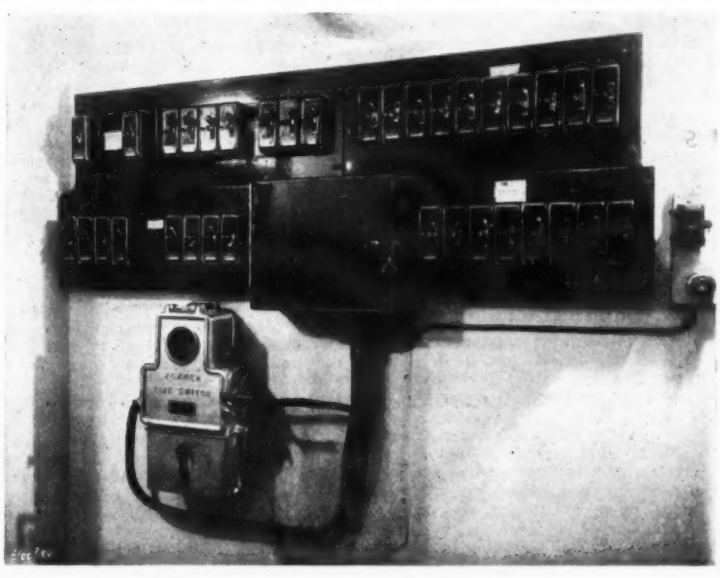
Of the outstanding tendencies in the best modern kinema design, the simplification of decorative form, together with greater use of illumination as an integral part of the design, was the most important. The illumination of painted traditional form and decoration was being superceded by the creation of colour derived solely from light, concealed or semi-concealed.

A Novel Wiring Job.

A recently-completed installation is believed to be the first of its kind in which miniature circuit breakers are used to the entire exclusion of fuses.

A NOTEWORTHY achievement is to be seen in the electrical installation by Messrs. Mortimer, Gall and Co., Ltd., at the new Peckham branch of a well-known west end store.

The system of supply is 230 volts, 50 cycles, single-phase, by the County of London Electric Supply Co., Ltd. The installation is carried out with screwed tubing, C.M.A. cable, with good-quality accessories. The total connected load is about 97½ kW, comprising 92 kW for lighting, 4½ kW for motors (lift), and 1 kW for electric cash registers. The outstanding feature of the job is the use throughout of miniature circuit breakers, no fuses being employed. The circuit breakers are arranged on the phase side only. Running through from the service position there is a d.p. ironclad main fuseboard covering the rising mains to each floor. The rising main to the ground floor, on which there are five circuit-breaker panels, with a total of 39 breakers, runs into a link box, which permits feeders being taken to each panel. Since there is only one panel on each of the remaining floors, further link boxes are unnecessary, and the mains run right into the bus-bars of the circuit-breaker panel. The circuit breakers on the ground floor covering the window lights also act as control switches, as also is the case in the showrooms. When more detailed or local control is desired, local switches are, of course, introduced. In the main part, however, one circuit breaker replaces a d.p. fuse-way (10 A) and a 10-A circuit switch, which must be mounted in an ironclad case if it is to equal the robustness of the circuit-breaker job, but it will not then be comparable with a miniature circuit breaker as used on this installation for compactness.



Miniature-circuit-breaker Distribution Board.

The circuit breakers themselves are of 6- and 10-A sizes, and on an average the loading is 6.5 A per breaker. A unique system of mounting the circuit breakers is the result of the efforts of the company's joint contracts manager, and is in the process of being patented. The cover of each breaker is removable for inspection purposes, individually, and by slackening four fixing screws the framing can be removed, leaving the bus-bars, terminals, and circuit breakers naked and easy to work on. It is claimed to be the work only of seconds to remove a circuit breaker and fill the space with a "blank," leaving the bus-bars, terminals, and circuit breakers naked and process, it is just as easy to remove a "blank" and insert an additional breaker; the mains and sub-mains are all capable of a 50 per cent. increase in load. The breakers used were unfortunately imported, and were selected on account of their consistency of operation. This was thought to be due to the sliding solenoid action of the breaker. Any excess of current, due to overload or leakage, or short-circuit, causes the iron core to hit against the vital point in the toggle action of the switch, causing it to open and remain open just as long as the excess current in the circuit existed. In subsequent jobs, however, the contractors have used with equal satisfaction a rather more compact breaker, employing an armature which is attracted to electro-magnets to knock out the switch by hitting the toggle joint.

In view of the fact that this job was secured in open competition, the comparison of costs is indicated as being favourable. Actually on prime costs the circuit-breaker job is slightly more expensive, approximately 10 per cent., but by introducing a little salesmanship, not only is a slightly bigger price obtained, but a unique and much better job, it is claimed, is performed.

Replacing fuse-wire needs semi-skilled attention, and even then there seems to be some confusion between hairpins and the correct size of fuse-wire. The time taken to find wire and somebody capable of replacing the fuse, even actually carrying out the work, is not to be compared with operating a circuit breaker, and in both commerce and industry, at any rate, "time" is spelt "£.s.d."

Power Station Auxiliaries.

Modern Developments in Respect of the Equipment Between the Condenser and the Boiler.

By H. HILLIER.

(Extracts from a paper presented to the London Technical Group of the ELECTRICAL POWER ENGINEERS' ASSOCIATION.*)*

THE troubles arising from impurities in the feed water are experienced in all parts of the power plant traversed by the working fluid, and are so serious that one of the chief duties for which modern feed systems are designed is to ensure that the water in circulation through the power plant is as free as possible from all gaseous and solid impurities. Possible sources from which impurities can enter the water in the system are as follows:—

1. Impure condenser circulating water can leak into the steam space of the condenser through defective tubes or packing; expanding the tubes into the tubeplates is now being adopted with encouraging success, and it practically eliminates tubeplate leakage.

2. Air and other gases may be absorbed by the water when passing through the condenser or other parts of the plant under vacuum, or in a feed or surge tank exposed to the atmosphere.

3. Make-up water supplied to the system to replace leakages may contain both solid and gaseous impurities.

One method adopted to prevent the water in the surge tank from absorbing air is to make the tank a closed vessel, and to supply steam at a pressure slightly above the atmosphere to the space above the surface of the water. Another method is to make the surge tank a closed vessel and connect the top of the tank to the condenser. These methods provide only a partial solution to the problem, which is completely solved by the Weir regenerative condenser and closed-feed system. With the closed-feed system the path of the water from the condensate pump to the boiler is entirely closed, and the entry of air is completely prevented. Variations between the demands of the boiler for water and the condensation of the steam exhausted from the turbine are automatically taken care of by the operation of make-up and overflow valves, which are relay-operated by the two floats in the bottom of the condenser.

Experience with this closed-feed system led to the development of the simplified "internal capacity" system, in which the bottom of the condenser is designed to form a large well having sufficient capacity to accommodate the variations in the rate of boiler steaming and feeding, the water level in the well rising and falling as necessary. Make-up water to cover the losses from the system is admitted under the control of a float-operated valve which opens whenever the water in the well falls below a predetermined level. In this system, the well in the condenser really takes the place of the feed tank in accommodating the variations in the feed system.

The "Optimum" de-aerator is the outcome of experience and research which have established the principle that the efficiency of de-aeration is increased by the rapidity of boiling. This de-aerator is very efficient in operation at either low or high temperature, and its operation is automatic and stable under all the widely varying conditions of working met in power-plant operation. De-aeration to the extent of 0.02 cu. cm. of oxygen per litre of water can be obtained at temperatures as low as 100 deg. F. A de-aerator can be installed in a feed system as a heater, and the drains from heaters at higher pressures can be led into the de-aerator, in which the total heat of such drains is conserved in the feed water without any further loss of heat head.

A very important part of the plant between the condenser and the boiler in a modern power station is the feed-heating system. Fortunately the greater part of the economy from regenerative feed heating can be obtained by bleeding steam at three, four, or five stages, depending upon the particular operating conditions. As the final feed-water temperature is increased, so must the number of feed-water heaters be increased to obtain the maximum economy, but the greater portion of the economy can be obtained with one heater. Taking steam at 325 lb. per sq. in., with a superheat of 250 deg. F. and an absolute pressure in the condenser of 0.75 lb. per sq. in., a turbo-generator can be designed to take 13,000 B.th.u. per kWh given out, without any feed-heating equipment. The addition of one feed heater using steam extracted from the turbine at 30 lb. per sq. in. abs. to give a feed temperature of 237 deg. F. would reduce the heat consumption of the turbine to 12,340 B.th.u. per kWh, thus effecting an economy of 5.1 per cent. The provision of two feed heaters using bled steam at 8 and 30 lb. per sq. in. absolute, respectively, to give the same feed temperature of 237 deg. F. would reduce the heat consumption of the turbine to 12,200 B.th.u. per kWh, the additional economy being 1.13 per cent. only. In both these cases it has been assumed that the drainage temperature is reduced to 120 deg. F. by a drain cooler. Generally speaking, the number of bled steam heaters fitted increases with the size of the plant.

Incorporated in one feed system is an evaporator which is supplied with steam bled from the turbine at 57 lb. per sq. in. abs. The vapour generated in the evaporator is condensed in one of the feed heaters, while the drainage from the heating coils is led into the drainage chamber. The condenser is provided with a closed-feed system, and since the feed heaters and the evaporator coils are supplied with steam well above atmospheric pressure, there is therefore no possibility of air contaminating the drainage water from them, and the water is returned directly into the feed system.

An interesting development in recent practice is that some turbine manufacturers are now designing the low-pressure ends of their turbines so that the moisture is withdrawn from the steam as it forms. A bled-steam orifice is arranged at a suitable point, and the collected moisture is discharged with the bled steam to a feed heater.

An interesting arrangement is that adopted by the Jersey Central Power & Light Co. for its new power station at South Amboy, New Jersey. At the present moment, two 25,000-kW units are being installed to operate with steam at 1,250 lb. per sq. in., 750 deg. F. total temperature at the turbine throttle, with five bled-steam points for feed-water heating. Steam is generated in the boilers at 1,400 lb. per sq. in., super-heated to 750 deg. F., and expanded in the high-pressure turbine to 415 lb. per sq. in., 520 deg. F.; the steam is then re-heated to 750 deg. F., by being passed in series through a steam re-heater and a gas re-heater, and enters the low-pressure turbine at 400 lb. per sq. in. absolute, 750 deg. F., to be expanded to the condenser vacuum of 29.5 in. From the data available and suitable assumptions it is estimated that this plant will have a heat consumption of about 9,050 B.th.u. per kWh.

The removal of the solid impurities in make-up feed water is almost invariably effected by evaporation. A central evaporating plant may be installed, or each turbine unit may be provided with an evaporator supplied with steam extracted from the turbine, the vapour generated in the evaporator being led into a suitable heater wherein it is condensed by the boiler feed water. A low temperature of evaporation should preferably be chosen, because the solubility of most scale-forming solids increases as the temperature of the water is decreased, and the precipitation of solids on the heating surfaces is thereby minimised. Considering now the cost of evaporation, modern practice is tending towards the installation of evaporators with each turbine unit. When comparing the steam consumption of different proposals for an evaporating plant it is necessary to evaluate the heat consumption of the evaporating plant in terms of boiler steam in order to obtain a true comparison. For this purpose, the value of the heat leaving the evaporating plant must be deducted from the value of the heat supplied to the plant, the cost of evaporation being that amount of boiler steam which would give up the corresponding amount of heat if allowed to do work when expanding from the boiler pressure to the condenser.

Double-effect evaporating plant is frequently installed with large turbine units. The cost of evaporation with a double-effect plant producing a combined output of 3 per cent. would be 42 kW or 420 lb. of boiler steam per hour, the evaporating plant producing 7.14 lb. of distillate per lb. of boiler steam. The heat consumption of the evaporating plant is approximately halved, but it should be mentoined that the capital cost will be about double that of the single-effect plant. Central evaporating plant is usually arranged to operate in triple or quadruple effect, and produces 2.6 and 3.4 lb. of distillate, respectively, per lb. of primary steam, which may be either bled-steam from a turbine or boiler steam. The true distillate ratio to boiler steam for a central evaporating plant can be determined only by a study of the operating conditions of each particular station. In many cases, the heat in the vapour and drains leaving the evaporating plant can be usefully absorbed in the feed water, and this, together with the value of the primary steam, must be taken into consideration.

With the advent of regenerative feed heating, the feed heating which can be effected by the exhaust from the turbine of the feed pump can sometimes be more economically effected by steam bled from the turbine, and this has led to the development of the motor-driven feed pump. Feed-pump

difficulties have been overcome by a combination of a turbine-driven booster pump operating in series with a constant-speed electrically-driven feed pump. The booster pump is controlled from a point on the feed line, after the feed heating system, so that the booster pump develops the additional pressure above the pressure developed by the electrically-driven pump as necessary to maintain a constant pressure at the boiler-feed regulators, with the result that the excess pressure across the feed regulators is constant at all loads and can be adjusted to the desired minimum. The overall thermal efficiency of this combination is better than that of the pure electric drive, being higher over the usual working range, although slightly lower at full power. The booster pump can be arranged in the feed-heating circuit to discharge the water through some of the feed heaters before it enters the electric feed pump. Since the booster pump discharge pressure is considerably less than the full boiler feed discharge pressure, the heaters can be of much lighter construction, which is a considerable advantage when the boiler pressure is high.

Discussion.

Mr. W. J. Oswald, chairman, said an extra half-per cent. efficiency was about all that could be aimed at now from the main power-station plant; but in the part of the plant between the turbine exhaust and the boiler a great deal could be done.

Mr. Carr said there was an enormous difference in the problems to be dealt with in the plant of a large power house such as Battersea, and those in many other stations not so happily situated. Where the load was constantly varying it would be necessary to install apparatus between the condenser and the boiler suitable to the conditions, and not the complicated type described in the paper. The first de-aerating plant was installed at Formby, in this country, and it had been found that de-aeration or de-gasification stopped corrosion. He favoured greater simplicity than seemed to be the trend suggested by the paper. At Padiham the plant was extremely simple. The development of equipment in large power stations seemed to be calling for specialist shift engineers for each section of the plant, and he suggested that there should be more grouping of plant of the type dealt with in the paper; for instance, the condensing plant should be brought to a common point.

Mr. C. Verity did not agree that the plant described was only suitable for stations with constant loads. A feature of the closed-feed system was the heat loss which was bound to occur unless certain precautions were taken. He complained that in too many papers read before engineering societies in this country the authors seemed to think that it was only from abroad that they could obtain their illustrations of what was being done. There were feed-heating and de-aerating equipments in this country which were equal in every way to those which were being supplied and operated in the U.S.A. and other countries. In the latest station with which he was associated there would be, when completed, five stages of feed heating and a final feed temperature of 350 deg. F., whilst the efficiency would be well up amongst the efficiencies that were published in the American journals.

Mr. J. T. Beebee said that in the power station where he was engaged there had recently been installed a 30,000-kW set, with a closed-feed system, and arrangements were made for getting away from the closed-feed principle by opening two valves, if it were required so to do. It appeared that nowadays three different types of charge engineer were wanted; one for the super-station, who would have a number of assistants to do the work under his supervision; the charge engineer peculiar to the London area in which such large load fluctuations took place; and the charge engineer for the smaller stations in the provinces, who had to look after repairs and overhauls.

Mr. Wyld did not think the lay-outs illustrated and described in the paper were so complicated as had been suggested. It was true that Padiham in its day put up an outstanding performance, but to-day it was being out-classed by stations equipped with systems which had been referred to as complicated. Regenerative feed systems of the types described in the paper resulted in very large savings in heat. The time was coming when they could afford to arrange the plant so that trouble on one or two units would not jeopardise the whole system. Indeed, there were now many systems working in this country and abroad where the shutting down of a 30,000- or 40,000-kW set did not jeopardise the whole supply, and the advantages to be obtained from the closed-feed system more than off-set the possible disadvantages in these circumstances.

The Author, replying to the discussion, said that the complicated system which had been so much criticised was actually to be installed in a station dealing with a railway load. Actually, the feed to the boilers in that case would be controlled by a central combustion control board. The whole station was so designed that there could be ten minutes supply of water between any point of control, so that there was no possibility of sharp changes in the load on the station being communicated to the feed system. The whole thing would be automatically controlled from two control boards, one in the engine room and one in the boiler room. The whole idea to-day was to make equipment such that it could be operated automatically. The point as to the difficulty of charge engineers being able to handle the so-called complicated plant was a question of the charge engineers educating themselves to be able to do so. His own view was that power station plant generally would tend to become more complicated rather than more simple. The large stations of the grid would be built so that maximum economy would be obtained, taking capital cost into consideration. It was evident that the engineers responsible for the "complicated plant" were quite satisfied that the heat economy to be obtained was worth the capital cost involved. The plant was better manufactured and better looked after in this country than in the U.S.A., and he said that after having visited ten of the high-pressure stations in the States.

The Fulham Inquiry.

A report of the inquiry by the Electricity Commissioners into the application by the Fulham Borough Council for permission to extend its generating station.

THE inquiry was opened at the Institution of Electrical Engineers, Victoria, Embankment, London, on Monday, December 15th, and was expected to continue for several days.

Sir John Brooke, C.B., was in the chair, and he had with him two other Commissioners, Mr. W. W. Lackie and Mr. T. P. Wilmshurst.

The applicant, the Fulham Borough Council, was represented by Mr. Tyldesley Jones, K.C., Mr. Graham Robertson, K.C., and Mr. Sydney Turner. There were several opponents to the proposals. The London County Council, the City of Westminster, and the Kensington and Chelsea Borough Councils were represented by Mr. J. E. Singleton, K.C., Mr. W. Trevor Watson, K.C., and Mr. J. H. Thorpe. The London and Home Counties Joint Electricity Authority was represented by Mr. J. Hodson, and the London Electric Power Co. by the Hon. Evan Charteris, K.C., and Mr. Craig Henderson, K.C. An appearance was also put in by a leaseholder of some property on land proposed to be taken for the purpose of the extensions.

Mr. Tyldesley Jones, K.C., whose opening speech occupied the whole of the first day, went at considerable length into the history of the development of electricity supply in London, the appointment of the Electricity Commissioners, and the setting up of the Central Electricity Board. He related the proposals with regard to the Duke's Meadows power station at Chiswick, which was authorised by Parliament at a time when the Central Electricity Board was being established, and how, after consideration of the South-East England Electricity Area, the Central Electricity Board decided not to proceed with the Duke's Meadows power station, but to extend the existing Fulham power station as a selected station for dealing with the growth of demand in the western area of London. It was pointed out that, when the supply of electricity in the Greater London area was first discussed in connection with the establishment of the London and Home Counties scheme in 1921, certain estimates of growth of demand were prepared by Messrs. Kennedy, Rider, and Wordingham, but that these estimates were to-day exceeded by 31 per cent. Moreover, events had also disproved the original idea that the bulk of the industrial development in the Greater London area would be in the east, because an enormous development was taking place both industrially and on the domestic side in the west, and in a manner quite unlooked for in 1921; hence came the decision to construct another selected station to deal with the western area.

Grounds of Opposition.

Pointing out that a great deal of opposition to the present proposals was on the score of possible nuisance from fumes and grit from so large a power station, Mr. Tyldesley Jones explained to the Commissioners that, as things stood at present

in respect of its generating station, the Fulham Borough Council was liable at law if it committed any nuisance and nothing that was proposed in the present application would modify that position. On the other hand, he claimed that he would be able to satisfy the Commissioners that a power station of large size could to-day be designed and constructed in a manner which would prevent nuisance of any kind, such as fumes, grit, vibration, or in any other way, and he urged that, if he were able to prove that, then the Commissioners should not withhold their consent on the ground, as seemed to be suggested in the petitions against the application, that certain apparatus to deal with fumes was not so far advanced as it might be. London, he said, should not be deprived of a cheap supply of electricity whilst experience was being gained with apparatus which, he claimed, had already been proved suitable for the purpose.

The Technical Proposals.

After pointing out that an agreement had been entered into between the Fulham Borough Council and the Central Electricity Board for the extension of the existing power station and the acquisition of certain adjoining lands for the purpose, Mr. Tyldesley Jones explained the proposals which were to be placed before the Commissioners. An area of 10 acres was to be acquired, the bulk of which would be covered by the extensions to the existing plant, the site having a river frontage of 1,025 ft. and a depth of 560 ft. The ultimate capacity of the power station would be 318,000 kW, which would give a working capacity of 312,000 kW. The first section—the subject of the present application—would have an installed capacity of 132,000 kW, giving an output capacity of 120,000 kW. The details of this plant were given as two 60,000-kW sets and two 6,000-kW sets. Generation would be at 11,000 volts, transformed up to 66,000 volts for the Board's transmission mains which had already been laid in the Fulham area. There would be two boiler houses eventually, each containing eight water-tube boilers, but at first only one boiler house would be erected in which six boilers fitted with mechanical stokers would be installed; pulverised fuel would not be used. The boilers would be arranged in two rows of four boilers each, with one chimney to each row, making four chimneys in all, each chimney being 300 ft. high. On the top floor of the boiler houses would be erected apparatus for dealing with the removal of dust or grit and also sulphur. A jetty would be constructed in the river capable of accommodating two 2,000-ton colliers at once and there would also be accommodation for the removal of ashes, together with modern coal-handling plant which it was claimed would prevent any nuisance due to dust in its operation. The estimated capital expenditure on the first section of the plant was £2,790,935, whilst the total capital expenditure when the extensions are completed was put at £5,530,000.

Removal of Sulphur Fumes.

Mr. Tyldesley Jones said that under the advice of Mr. J. H. Rider (the Council's consulting engineer), Mr. A. J. Fuller (the Council's electrical engineer and manager), and Dr. R. Lessing (the Council's consulting chemist) there had been erected at Fulham, and was now in actual operation, full size apparatus for removing sulphur dioxide from the flue gases. The Fulham Borough Council, he added, was as anxious to keep the air of London pure as was the London County Council, and therefore it had gone to considerable expense to carry out experiments with regard to this matter on somewhat different lines from those adopted in connection with the Battersea power station by the London Power Co. He impressed upon the Commissioners that the Borough Council desired that conditions should be attached to their consent to this application which would have the effect of preventing, as far as was possible in the present state of knowledge, any nuisance from this or other causes. He claimed, indeed, that the problem in relation to nuisance from sulphur fumes, grit, vibration, &c., had all been solved and that, although a great deal was made of the way London had suffered in the past from these causes, it had to be remembered that such nuisance was caused by power stations erected many years ago under totally different conditions from those now applying to so large a power station as that contemplated by this application. Moreover, it was difficult to adapt these older power stations to methods now available for dealing with these problems.

The method of dealing with sulphur fumes at Fulham, he said, consisted in bringing the flue gases into intimate contact with water by means of an arrangement of pipes placed in the chimney flues, details of which would be given in the evidence. He asked the Commissioners to take an opportunity of seeing the plant in operation, and he also invited those opponents who had fears with regard to fumes to do likewise.

In reply to Mr. J. E. Singleton, K.C. (for the London County Council), Mr. Tyldesley Jones said the tests were not yet sufficiently complete to be put forward, but they would be placed before the Commissioners before the inquiry ended.

Replying to a query whether this meant that the apparatus was not yet considered satisfactory, Mr. Tyldesley Jones said that such was not the case, but it was inevitable in the case of new apparatus that adjustments should be necessary. Continuing, he said the Borough Council was advised that this provided a complete solution of the problem of fume emission and it was realised how vital a matter it was. He impressed upon the Commissioners the view that if they were satisfied that a method had been devised, whether it were the one at Fulham or the one at Battersea, which would deal with sulphur fumes, even if such method had not reached the most perfect state, they should give their consent to the proposals of the applicants, because evidence would be given of the astonishing increase in the demand for electricity in recent years. The demand had outstripped all anticipations and when it could be fully met it would go a long way to meeting the complaints of emissions from domestic and factory chimneys. Indeed, the London County Council's own recent publications testified to the fact that the atmosphere of London was becoming purer, and that was obviously due to the increasing use of electricity. Surely, therefore, the London County Council did not wish to stop that development by preventing the extension of a power station which would do a great deal in that direction by producing cheap electricity.

Mr. H. Hobson (supply engineer, Central Electricity Board) was called on Tuesday, December 16th, as the first witness for the application, and explained that the Central Electricity Board had abandoned the proposed Chiswick station because it did not consider the Duke's Meadow site suitable for a station to deal with the increasing load in the western area. He added that the main transmission lines of the Central Electricity Board were laid in Townmead Road, in which the Fulham power station was situated, and were ready to be connected up as soon as the necessary sub-station was built. The oil tank for keeping up the pressure in the oil-filled main transmission cables had also been erected in the power station. Additional plant required for the western area by 1940-41 would be 1,400,000 kW, or an average annual addition to the plant of 147,000 kW, and it was regarded as a most urgent matter that the first section of the Fulham extensions should be in operation by October, 1933. Even if the Commissioners gave their sanction within two or three weeks, that only left 2¾ years, and it would be a creditable performance on the part of contractors and engineers if such a plant were in commercial operation in less than three years.

Increase in Price without the Fulham Station.

Mr. Hobson then discussed suggestions that had been made for the erection of a station down the river, *e.g.*, at Erith, and the transmission of energy to the western area. He said the Central Board was emphatic that to use overhead lines for such transmission would be impracticable for physical reasons, whilst to use underground cables would make the cost prohibitive. To transmit 300,000 kW would require four double-circuit overhead lines; the only conceivable route would be well round to the north or south, and they would have to go underground from such points as Willesden or Brimsdown. Moreover, the difficulty of obtaining wayleaves in the outer London area was very great. To find a route for underground cables would be even more difficult. Already it had been found almost impossible to find a route for 33,000-volt cables. However, quite apart from this, there was the question of the extra cost. To transmit the 120,000 kW contemplated in the first section at Fulham would add £889,000 (£6.72 per kW installed) to the capital cost, and to transmit 300,000 kW would add £2,243,000 (£7 per kW installed). This meant an addition of more than 30 per cent. to the capital expenditure on the first section of the extensions, and more than 40 per cent. to the cost of the completed station; moreover, this station would be responsible for only 10 per cent. of the total output required in the area. There would also be additional charges in working costs, and the total effect would be an addition of 0.0475d. per kWh to all the energy generated at Fulham and 0.012d. per kWh to all the energy supplied in the London and Home Counties area. He doubted, however, whether that charge could be applied equally to all who purchased from the Board, as certain of the owners of selected stations would probably be able to resist the charge because under Section 13 of the Act the Board could not charge more than the cost at which these undertakings themselves could generate a similar quantity of energy. Therefore, a charge up to four times the figure he had mentioned would have to be added to the price charged to the smaller undertakings who purchased from the Board, and that would clearly have a detrimental effect on the demand and generally prejudice the whole scheme.

Mr. Hobson added that the Central Electricity Board would not have supported the scheme if the extensions at Fulham could not be carried out without causing serious nuiance and hardship to the surrounding district. The Board felt satisfied, after the publication of the second report of the Government chemist, that no nuisance would be caused.

Underground Cable Costs.

Mr. J. R. Beard (partner in the firm of Merz & McLellan, consulting engineers to the Central Electricity Board in respect of four or five schemes, including the South-east England scheme) was then called and dealt with the cost of transmission from a station down the river to the western area. Referring to the suggestion made in a letter to *The Times* by the Mayor of Chelsea recently that the cables could be laid in the river from Erith to Fulham, Mr. Beard said that, to begin with, the length of route by river could be 40 per cent. longer than the shortest road route, and, as the cost of the excavations was only one-quarter the total cost of the cable, to lay the cables in the river would cost a great deal more, even assuming the cables could be laid in the river for nothing, which was not the case. There would be serious difficulties in maintenance, and it would not be possible, from the engineer-

ing point of view, to lay such high-voltage cables under water, owing to the fact that a special non-magnetic type of armouring would have to be used. Dealing with the laying of underground cables between a station at Erith and Fulham, Mr. Beard said he had taken 18¼ miles as the shortest possible route, and the inclusive cost of laying four 66,000-volt cables would be £48,096 per mile, based on recent contracts. The additional capital charges would be £82,800 per annum and the losses would cost £15,190, making for the first stage, a total additional annual charge of £97,995. For the final stage of the station, the figures had been worked out for four 132,000-volt cables based upon prices paid by the Central Board for experimental lengths of such cable. These figures showed annual capital charges amounting to £125,900, and losses amounting to £14,335 per annum, or a total of £140,230. Thus if the whole output contemplated from Fulham was sent by underground cable from Erith, the additional annual charge would be £238,220 on account of the cables, in respect of a total additional capital expenditure of £2,243,000.

Details of the Proposed Station.

Mr. J. H. Rider, consulting engineer to the Fulham Borough Council, stated that the boilers would have an evaporative capacity of 250,000 lb. of water, actual, per hour, at a pressure of 600 lb. per sq. inch. There would be two floors above the boiler houses, one containing the air-heating plant, the forced and induced draught fans, and the main dust-catching plant, consisting of cyclonic dust catchers. The other floor would contain the sulphur-fume apparatus. A reserve stock of 31,000 tons of coal would be carried in two silos enclosed in concrete walls, the coal being kept under water. With a coal having a calorific value of 10,600 B.th.u. per lb., the station would burn 860 tons per day when the first section of the plant was complete, or 2,150 tons per day when the final stage was erected. The overall efficiency was estimated at 25 per cent. with a 50 per cent. load factor, whilst the coal consumption per kWh was put at 1.2925 lb.

Referring to the removal of sulphur fumes, Mr. Rider said the principle of the method now in operation at Fulham was not different from that of the experimental apparatus at the Battersea power station, *i.e.*, scrubbing the gases by means of water with or without added chalk or lime. The method adopted at Fulham was known as the "Mondave" process, and was in operation in several places abroad and was originally designed for dealing with dust. Before the flue gases reached the washing apparatus, 90 to 96 per cent. of the dust would have been removed by the dust catchers.

(To be continued.)

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

A New Bird Guard.

The SOCIETE LA BAKELITE DE PARIS (14, Rue Roquepine) has recently patented and put on the market a simple device to prevent the risk of accident due to birds settling on insulators and coming into contact with overhead-line conductors. The device, fig. 1, consists of a light cover of non-conducting material which not only fits over the insulator, but also over a short length of the conductor in its vicinity.

Fig. 1.—"Bakelite" Bird Guard in Position.

A Development in Coalcutter Picks.

The limit of hardness of material that can be cut to economic advantage by the best modern coalcutters is imposed less by the strength and power of the machine than by endurance of the cutter picks. A recent development in engineering manufacture is the use of extremely hard non-ferrous alloys as tips for tools in the cutting of metals, and in their works Messrs. MAVOR AND COULSON, LTD., 47, Broad Street, Mile End, Glasgow, have taken full benefit of this innovation. Their experience of the characteristics of these new alloys for cutting metals soon suggested that they might have an important bearing on the problem of coalcutter picks. A series of experiments was therefore undertaken to determine the best compromise between extreme hardness, with its consequent brittleness, on one hand, and a degree of hardness combined with the requisite toughness, on the other. The result of this research is that the company is now producing in quantities cutter picks that it claims are a great improvement on anything hitherto attained, and which make available for coalcutting the fruits of the most recent experience gained in the cutting of metals. As an example of successful use of the new picks, on a face where tempered steel picks had to be changed about every ten yards, a set of the non-ferrous metal-tipped picks cut 80 yards, and the picks were then only slightly damaged.

A Soldering-iron Heater.

The advantages of electrically-heated soldering irons are said to have been nullified to some extent by their tendency to overheat or burn out at inconvenient times. It is put forward that a perfect electric soldering equipment should (*a*) be electrically controlled so that it cannot burn out if the current is left on, or by overheating burn the solder, give out unhealthy fumes and get a dirty surface which has to be cleaned before use; (*b*) have no heating element inside the actual iron, or electrical connection to the soldering bolt, thus making it possible to use any bolt within the rated dimensions of the outfit; and (*c*) be as light in weight as possible to minimise fatigue to the worker.

The soldering outfit illustrated in fig. 2 is made by the WESTMINSTER TOOL & ELECTRIC CO., LTD., "Westool" Works, Putney, S.W.15, and it is claimed to embody many of the above requirements. It consists of a small electric muffle enclosed in an aluminium case, and the heating chamber is a circular metal tube closed at one end. This is wound for any voltage and generally rated at 120 watts, and maintains a constant controlled temperature inside the metal tube in which the bolt is heated. Overheating is impossible, and the bolt is always clean at the right temperature, ready for use. Since no flexible conductor is required the weight of the bolt is a minimum, and experience proves that it may be used for long periods without fatigue, an important point where female labour is concerned. The outfit is invaluable to all who have to make joints in copper wires, thin metal sheets, &c.

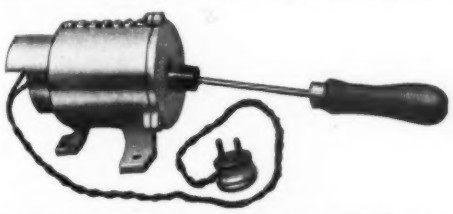


Fig. 2.—"Westool" Electric Soldering Equipment.

Large 3-phase 4-winding Transformers.

The OERLIKON CO., LTD., Victoria House, Southampton Row, W.C.1, has recently received an order for two transformers for the new power station of the Ryburg Schwoerstadt Power Supply Co., Switzerland, which are notable, both as regards their capacity and special design. As they have to be capable of feeding three different h.p. systems operated at different pressures, it has been necessary to provide the transformers with three h.p. windings independent of each other and designed for the whole transformer capacity. The plant is for outdoor mounting with low-pressure cooling, vacuum oil tanks, and separate oil coolers. The transformers are each built to the following particulars: rating of each of the four windings, 32,500 kVA; pressure ratio 10.5-kV primary to 48-/116-/145-kV secondaries, with two tappings for ± 5 per cent. on the 116- and 145-kV windings; connections, 10.5 kV delta, 48, 116 and 145 kV star, with fully insulated neutral.

The transformation has not only to take place at full capacity, from the l.p. winding at 10.5 kV to one of the three h.p.

windings, but also, simultaneously, between the other two h.p. windings, in either direction, for the transfer of power from one of the h.p. distribution systems to the other. The cooler equipments are mounted separately, and are designed to dissipate the maximum iron and copper losses when the transformer is working with any two windings. It will be possible later on to render the cooler equipments capable of dissipating the total losses, when all four windings are carrying 35,000 kVA simultaneously, merely by increasing their size. The short-circuit pressure between the individual windings vary between 8 and 16 per cent. The transformers are to be capable of dealing with the short-circuit conditions at the power station, where each will be arranged with its l.p. winding linked up direct to a three-phase generator of the same capacity and with each of the three h.p. windings connected to a very extensive h.p. distribution system. The total weight of a transformer, including its cooler equipment and oil, amounts to 240 tons.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

The Two-part Tariff.

I am glad that Mr. Ernest G. Pink has now given some clue to the form of tariff he recommends, which is apparently a fixed charge on kilowatts connected, plus a charge per kWh to cover the extra cost of fuel when current is being taken. This is a great improvement on his first letter, which contained such extraordinary statements as .... "peak load is a misnomer."

It is clear that Mr. Pink is even less enamoured of the Committee's tariff than I am. I objected to the connected load being ignored. He would base the whole fixed charge solely on the kilowatts connected. To that extent I can claim him as a supporter. The crux of our differences lies in his statement that the amount of the capital charge is controlled by the kilowatts of apparatus connected to the mains. As Mr. Pink would say, "this is directly opposed to fact." The capital charges are controlled by the maximum kilowatts of apparatus actually switched on at the same time. This is so obvious that I can only conclude that Mr. Pink uses these terms in a different sense from other engineers, and it is therefore useless to argue with him.

G. L. Porter.

Hollingwood, *December 18th*, 1930.

Too Old at Forty?

The correspondence under this heading would appear to be entirely blind to the view point of the employer.

Your correspondent "Young at Fifty" compares the man of forty with a suit-case that will last a lifetime. *If* the man of forty would last a lifetime he would get the job almost every time, because he is admittedly at his best, but, in 20 years' time he will be a man of 60, and past his best, whereas the youth of 20 will in that same time be 40 and at his zenith.

In the employ of my firm we have at present two men, both approximately 60, and both suffering from ill-health, one from chest trouble and the other from a digestive complaint. The first man has been with us for 35 years and the other for 15; in the first case there is every moral right to a pension; in the second there is no such right, though it may be given as an act of charity. Surely, however, it is obvious that no firm is too anxious to take on employés who may become pensioners in 15 years' time.

There is also the junior to be considered; he is (or should be) working hard to qualify for a senior post, and if, with the passing of time, such becomes vacant, he wants to be given his chance, and it would take all the "steam" out of our younger blood if we continually brought men in over their heads.

These are the practical considerations that an employer simply has to bear in mind.

An Employer of Experience.

December 18th, 1930.

Advice Wanted.

Being faced with the following problem, I shall be grateful for helpful suggestions from those competent to advise.

My son—age 17—is shortly leaving his public school, and is adapted for and anxious to follow some branch of electrical engineering. He is practical, and has done fairly well at school in science and mathematics, but naturally has no fixed views as to the branch of electrical engineering he is best fitted for, except that he thinks he would like to follow me in my electrical contracting business. I am naturally anxious to do my best for him, and wish him to be well fitted for his future career.

Some of my engineering friends are strongly in favour of his being given a few years course at a technical institute—say at Faraday House—whilst others are strongly of the opinion that he should go direct into the employ of a large contracting firm, or into engineering shops of some description, for practical and commercial experience, backed up by attendance at evening classes. They maintain that by so doing he will best gain, by actual experience, the necessary tuition—both practical and technical—which should enable him to choose and follow up a career from which he can earn a good livelihood later.

Pater.

December 15th, 1930.

Hire-purchase of Electric Irons.

I have read with interest the letter from Mr. T. A. G. Margary, of Wolverhampton, regarding the Corporation's assisted wiring scheme in connection with electric irons.

The scheme appears to be substantially the same as the one instituted in Wallasey in April last, together with the additional charge of 2d. per kWh.

I am afraid I do not quite agree with the method of introducing probably the most useful domestic appliance to the new consumer. My Corporation, instead of making any charge for irons, supplies one free, and also fixes a plug similar to what is done at Wolverhampton.

It may be interesting to state at this point that 3,120 consumers have been connected to date under the assisted wiring scheme, and hence the same number of irons have been distributed free to these consumers.

Already this inducement to use small domestic appliances has been felt, as we get numerous inquiries now for hire-purchase of various small apparatus.

B. T. Hawkins.

Wallasey, *December 13th*, 1930.

British Motor Prices.

Judging by the comments made in the correspondence under the above heading, it would appear that Mr. Mallett wishes the long-suffering "user" to pay more for electric motors than hitherto.

Does it not stand to reason that, if an electric motor manufacturer can, by economic production, market a low-priced, efficient and reliable article, he should retail it at a figure that will bring him a fair and reasonable profit?

If certain motor manufacturers have to raise their selling prices to help to support concerns that lack initiative and enterprise, is this not tending to open the door by which the foreigner can enter and capture our electric motor market?

Despite adverse opinions, the "Meccano" motor, as it has been called, has come to stay. The motor-car industry has realised the advantages of pressed steel, and it is time that other branches of engineering followed in the steps of progress.

It is to the advantage of the British manufacturer to reduce capital outlay, and keeping down expenditure on electrical plant will help to attain this object.

H. L. Wickes.

Birmingham, *December 15th*, 1930.

The last paragraph of the letter from your correspondent "Inspector" (ELEC. REV., December 12th, page 1026) is very interesting.

It is a fairly well-known fact that any faulty material in an electric motor will make itself known within three months, or at the very outside within the 12 months covered by most manufacturers' guarantees. The long-period guarantees offered by some manufacturers exclude damage caused other than by faulty material, workmanship, or design.

It is, therefore, a conclusive argument that if a machine will run for more than 12 months there can have been no faulty material or workmanship in it, and a guaranteed period longer than this is practically useless. On the other

hand, a conscientious firm will always stand behind its products, should there be proved a definite fault, whether it is discovered inside the guaranteed period or not.

Power Contracts (Batwin), Ltd.,
H. G. POXON,
Sales Department.

London, S.E.1, *December 16th*, 1930.

[This correspondence is now closed.—EDS. ELEC. REV.]

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1929.

15,632. "Thermostatic devices for electrically-heated fabrics." A. Negronenti. May 18th, 1929. (338,880.)

15,989. "Electric remote-control systems." Anciens Etablissements Sautter-Harle. May 23rd, 1928. (312,282.)

16,189. "Synchronous telegraphic apparatus operated by alternating current." O. Muck. May 25th, 1929. (338,890.)

16,378. "Mouthpiece arrangements for use with telephones and the like." D. S. S. Steuart. May 28th, 1929. (Cognate application, 32,185/29.) (338,892.)

16,581. "Electric accumulators." Soc. Anon. des Accumulateurs Monoplaque. January 29th, 1929. (338,921.)

16,582. "Electric accumulators." Soc. Anon. des Accumulateurs Monoplaque. February 26th, 1929. (Patent of addition not granted.) (338,932.)

16,586. "Apparatus suitable for television." British Thomson-Houston Co., Ltd. May 29th, 1928. (312,651.)

16,670. "Electron-discharge devices." British Thomson-Houston Co., Ltd. June 1st, 1928. (312,922.)

16,958. "Apparatus for the determination of the concentration of blood, milk, and other suspensions by means of electric current." A. Slawinski. June 1st, 1929. (338,928.)

17,963. "Electric totalisators." A. Deurrieux, J. Pomaredes, and L. Perret. June 29th, 1928. (Patent of addition not granted.) (314,548.)

22,113. "High-tension condensers." Hermsdorf-Schomburg-Isolatoren Ges. April 12th, 1929. (Addition to 291,424.) (338,895.)

22,362. "Remote indicator and supervisory system." Standard Telephones and Cables, Ltd., E. M. S. McWhirter, and J. G. Flint. July 20th, 1929. (338,853.)

22,391. "Quick-break thermally-actuated switch." Scherbius & Ritter and L. Scherbius. September 7th, 1928. (318,611.)

22,596. "Manufacture of electrical insulating material." Dr. A. Wacker Ges. für Electrochemische Industrie. July 23rd, 1928. (316,146.)

22,680. "Electrical pin-and-socket couplings." J. A. Crabtree and B. G. Harrison. July 24th, 1929. (338,896.)

22,944. "Electric fuses." Simplex Conduits, Ltd., and H. F. McLoughlin. July 26th, 1929. (338,865.)

23,080. "Electrical indicating or display devices." Automatic Telephone Manufacturing Co., Ltd., C. Gillings, R. Taylor, and L. M. Simpson. July 26th, 1929. (Cognate application, 4,349/30.) (338,897.)

23,669. "Electric purification of gas by means of rectified alternating current of high potential." Siemens-Schuckertwerke Akt. Ges. April 17th, 1929. (338,944.)

25,756. "Electrodes for electrolytic purposes." S. G. S. Dicker (Naamlooze Vennootschap Electro-Chemische Industrie). August 23rd, 1929. (Convention date not granted.) (318,154.)

25,768. "Wireless receiving apparatus." J. L. Routin. March 7th, 1929. (Addition to 316,985.) (338,903.)

25,849. "Electric switches." S. Ruppel. August 24th, 1929. (338,885.)

25,894. "Sound-recording and reproducing apparatus." S. I. Hitchcock. August 26th, 1929. (Cognate application, 28,477/29.) (338,906.)

25,910. "High-frequency signalling systems." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). August 26th, 1929. (338,873.)

25,911. "Electrical condensers." Standard Telephones and Cables, Ltd., and S. H. Boss. August 26th, 1929. (338,874.)

25,912. "Automatic or semi-automatic telephone systems." Standard Telephones and Cables, Ltd., G. C. Hartley, and E. P. G. Wright. August 26th, 1929. (338,875.)

26,037. "Control of electrically-operated apparatus." Siemens Bros. and Co., Ltd., and D. A. Christian. August 27th, 1929. (338,909.)

26,215. "Traffic-control signals." Automatic Telephone Manufacturing Co., Ltd., W. H. Paulett, T. G. Rice, and M. O. Williams. August 28th, 1929. (338,917.)

26,375. "Interpolating arrangements for electric telegraphs." Electrical Research Products, Inc. December 31st, 1928. (338,970.)

26,376/7. "Telephonic and like signal transmission systems." Electrical Research Products, Inc. June 11th, 1929. (338,971/2.)

26,378. "Electric telephone and like transmission systems." Electrical Research Products, Inc. June 11th, 1929. (338,973.)

26,404. "Construction and mounting of diaphragms for wireless loud-speakers, gramophones, and other sound-reproducing apparatus." A. F. S. Kent. August 30th, 1929. (Cognate application, 36,936/29.) (338,974.)

26,447. "Electric switches." International General Electric Co., Inc. August 31st, 1928. (318,262.)

26,487. "Rotors for three-phase motors." Naamlooze Vennootschap Ingelosche Elektrische en Mechanische Apparatenfabriek and A. Booden August 30th, 1929. (338,977.)

26,543. "Electric rectifying devices and method of making the same." M. Lazarus. August 31st, 1929. (Convention date not granted.) (318,265

26,544. "Masts for wireless aerials." H. L. Kirke. August 31st, 1929. (338,982.)

26,891. "Cores for air-blast shell-type transformers." British Thomson-Houston Co., Ltd., and H. S. Holbrook. September 4th, 1929. (339,000.)

26,920. "Variable electrical condensers." W. O. Heyne and Plessey Co., Ltd. September 4th, 1929. (339,001.)

27,944. "Luminous electric discharge tube." Rainbow Light, Inc. September 14th, 1928. (319,016.)

28,431. "Mercury-vapour rectifiers." General Electric Co., Ltd., and J. W. Ryde. September 19th, 1929. (339,022.)

29,914. "Incandescent electric lamps." B. B. Fenn. October 2nd, 1929. (339,036.)

30,150. "Metal-clad switchgear of the draw-out type." D. R. Davies. October 4th, 1929. (339,041.)

30,551. "Loading of signalling conductors." Electrical Research Products, Inc. November 8th, 1928. (Patent of addition not granted.) (339,049.)

30,662. "Electric accumulator and electrode therefor." A. G. Owens. October 9th, 1929. (339,050.)

30,791. "Push-pull amplifier circuits." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 10th, 1929. (339,058.)

31,484. "Electron-emitting cathodes for electric discharge devices." Gramophone Co., Ltd., W. F. Tedham, and F. Ellington. October 16th, 1929. (339,057.)

31,716. "Protection of dynamo-electric machines." General Electric Co. Ltd., and C. C. Garrard. October 18th, 1929. (339,059.)

32,326. "Vapour-electric rectifiers." General Electric Co., Ltd., and E. Gallizia. October 24th, 1929. (339,063.)

32,993. "Control systems for electrical apparatus." Associated Electrical Industries, Ltd. October 30th, 1928. (339,066.)

33,333. "Sound and picture recording or reproducing apparatus." British Consolidated Investments Corporation, Ltd. November 2nd, 1928. (339,073.)

33,995. "High-potential electric switches." Associated Electrical Industries, Ltd. November 12th, 1928. (339,084.)

36,191. "Sheathing for electric cables." C. J. Beaver, N. Dixon, and W. T. Glover & Co., Ltd. November 26th, 1929. (Cognate application, 11,403/30.) (339,104.)

36,931. "Synchronising systems for use in television and like systems." Marconi's Wireless Telegraph Co., Ltd. November 30th, 1928. (339,112.)

37,253. "Electric cut-out devices for motor vehicles." W. A. Newton, J. W. Bowser, and F. Lum. December 5th, 1929. (339,114.)

38,549. "Electrical apparatus for controlling a motor from a distance, more especially applicable to ships' steering gear." W. H. Scott. December 16th, 1929. (339,123.)

38,658. "Apparatus for the reproduction of sound having a diaphragm of relatively large surface and a screen plate." J. C. Douw, J. W. V. Hein, C. H. Henny, and M. A. Henny (trading as J. C. Douw's Patents Syndicate). July 26th, 1929. (339,127.)

38,947. "Electric switches for sparklessly interrupting alternating-current circuits." British Thomson-Houston Co., Ltd. December 24th, 1928. (339,133.)

39,780. "Safety devices for stopping machines driven by electric motors." S. Fukuda and Y. Okasaki. December 30th, 1929. (339,145.)

39,872. "Device for securing the end connections of rotary windings in dynamo-electric machines." Allgemeine Elektricitäts Ges. November 13th, 1929. (Addition to 338,014.) (339,147.)

1930.

1,674. "Electric light shades and fittings." S. W. Hamlyn and Louis Dernier & Hamlyn, Ltd. January 17th, 1930. (339,164.)

6,053. "Loud-speaker and circuit therefor." Farrard Inductor Corporation. February 26th, 1929. (339,205.)

6,240. "Electric induction motors." J. W. Swendsen. February 26th, 1929. (339,206.)

6,709. "Combined machine, comprising a radial turbine and electric generator." Siemens-Schuckertwerke Akt. Ges. March 1st, 1929. (339,211.)

6,938. "Apparatus for X-ray investigation." Siemens-Reiniger-Veifa Ges. für Medizinische Technik. March 1st, 1929. (Patent of addition not granted.) (339,212.)

7,674. "Method and apparatus for use in making X-ray photographs." C. H. F. Muller Akt. Ges. March 9th, 1929. (339,215.)

10,644. "Electrical musical instruments." M. L. E. Martenot. April 3rd, 1930. (Convention date not granted.) (339,225.)

11,205. "Electrical insulators." Hermsdorf-Schomburg-Isolatoren Ges. April 11th, 1929. (339,226.)

11,453. "High-tension electric insulators." International General Electric Co., Inc. April 11th, 1929. (339,227.)

16,635. "Electric signalling systems." British Thomson-Houston Co., Ltd. May 29th, 1929. (339,234.)

27,875. "Apparatus for transmitting orders, signals, or the like between one position and another electrically." Chadburn's (Ship) Telegraph Co., Ltd., and A. C. Bamford. July 29th, 1929. (Divided application on 337,396.) (338,991.)

29,310. "Automatic-reclosing apparatus for electric switches or circuit breakers, with arrangements for extinguishing the arc by gas under pressure." S. Ruppel. August 22nd, 1929. (Divided application on 337,508.) (338,878.)

32,704. "Electrical insulators." Hermsdorf-Schomburg-Isolatoren Ges. December 5th, 1928. (Addition to 289,709.) (Divided application on 337,748.) (338,992.)

34,739. "Electric totalisators." A. Deurrieux, J. Pomaredes, and L. Perret. June 29th, 1928. (Divided application on 314,548.) (338,993.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 17th :—

Silver Hawk (lettering and design). No. 515,557. Class 6. Machinery of all kinds.—L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, W.C.2.

Kellocater (lettering and design). No. 515,582. Class 6. Electrically-controlled machines for locating or laying out work on drilling, punching, pressing, and like machines.—Keller Engineering Corporation, Brooklyn, N.Y., U.S.A. (British representatives: A. M. & W. Clark, 53-54, Chancery Lane, W.C.2.)

Red Star. No. 512,314. Class 8. Radio-receiving sets, low-frequency transformers, variable condensers, battery eliminators, and gramophones.—Peggy Vale, Winterdyne, Holly Lane, Erdington, Birmingham.

Sunshine. No. 516,766. Class 8. Electric batteries (not for medical purposes).—L. & I. Rosenberg, 40-42, Hanover Street, Shudehill, Manchester.

Lumophon. No. 517,450. Class 8. Instruments and apparatus for use in radio-telephony and telegraphy.—Julius Axelrad, 91, Great Russell Street, W.C.1.

The Lively "O." Class 8. No. 517,532. Electric batteries and accumulators (not for medical purposes).—Oldham & Sons, Ltd., 36, Hyde Road, Denton, Manchester.

Paulette. No. 517,846. All goods in Class 8.—J. F. Paull, trading as Paull's Wireless Stores, 43, Caroline Street, Cardiff.

Ultrasol. No. 514,338. Class 11. Instruments, apparatus, and contrivances (not medicated) for surgical and curative purposes.—Naamlooze Vennootschap Philips' Gloeilampenfabriek, Eindhoven, Holland. (British representatives: Boult, Wade & Tennant, 112, Hatton Garden, E.C.1.)

The London and Home Counties Increased Supply Area.

The London and Home Counties Electricity Authority has received sanction from the Electricity Commissioners to acquire the undertakings of the Surbiton Electricity Supply Co., the Leatherhead and District Electricity Co., Ltd., the Dorking Electricity Supply Co., Ltd., and the Middlesex portion of the undertaking of the Twickenham and Teddington Electricity Supply Co., Ltd. After January 1st the Authority's standard charges will come into operation in the added area and will mean a reduction to consumers ranging from 12 to 33⅓ per cent. The area involved covers 112 sq. miles and has a population of 128,000.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

BARNSTAPLE.—Houses (86) for the R.D.C.; surveyor.

BANSTEAD (SURREY).—Admission villa, mental hospital W. H. Gaze & Sons, Ltd., Kingston.

BEDFORD.—Houses (500) during next five years; borough engineer.

BIRMINGHAM.—Alterations and extensions to premises of Clayton-Wright, Ltd., Great Hampton Street; Trow and Sons, builders, 97-99, Antrobus Road, Handsworth, Birmingham. Alterations and improvements to factory premises in Cox Street for S. Smith & Sons (M.A.), Ltd.; George Webb & Sons, Ltd., builders, Soho Hill, Soho Road.

BLACKBURN.—Extensions of Cicely Bridge Mill for Messrs. Baynes.

BLYTH.—Houses (110), Morpeth Road (£37,990); borough engineer.

BRIGHTON.—Showrooms, offices and flats, Old Steine; H. D. Butler.

CARLISLE.—Waterworks, plant, &c. (£41,200); water engineer.

COALVILLE.—Municipal buildings for the U.D.C.; surveyor.

COVENTRY.—School (£45,000) for the borough E.C.; director of education. Houses (250) for the T.C.; city surveyor.

DARLASTON.—Houses (168) for the U.D.C.; Mr. Teece, builder.

DURHAM.—Intermediate school, Ryhope (480 places), for the E.C.; F. Willey, architect, 34, Old Elvet.

EDINBURGH.—Houses (1,000) for the T.C., burgh surveyor.

FAVERSHAM.—Houses (150) for the R.D.C.; surveyor.

FIFESHIRE.—New town hall (600 seats) for Kinghorn T.C.; burgh surveyor.

GIRVAN.—Houses (60) for the T.C.; burgh surveyor.

GLASGOW.—New church at Carntyne; Rev. John Taylor, Carntyne Old Church. Reconstruction, Waterloo Street premises (£30,000); electrical engineer and trade contractors. Extensions, Glasgow High School; master of works, Education Offices, Bath Street.

GRANGETOWN (YORKS.).—School for the R.C. managers; priest-in-charge.

GRAYS.—Library extensions for the U.D.C.; H. S. Goodall, surveyor.

GLOSSOP.—Houses (50); borough engineer.

IRISH FREE STATE (CORK).—Houses (168), Turner's Cross, for the Corporation; Chillingworth & Levie, architects, 11, South Mall.

LANCS.—School (350 places), Tottington, for the county E.C.; director of education, Preston. Senior school, Worsley, for the County Council E.C.; J. Cocker, Ltd., builders, Station Street, Walkden.

LICHFIELD.—Hospital (£25,000); Thomas T. Pole, architect.

LIVERPOOL.—Junior and senior mixed school, Chatham Place; Foden, Hemm & Williams, 199, Deansgate, Manchester.

LONDON (EAST HAM, E.).—School (350 places) for the borough E.C.; F. R. Thompson, secretary.

(HACKNEY, E.).—Factory, Eastern Arterial Avenue; Williams, Pettett & Gardner. Shops, Ridley Road and Dalston Lane; Staples & Morley.

(POPLAR, E.).—Reconstruction, Baker's Alley area; L.C.C. architect.

(WEST HAM, E.).—Central schools (£28,843) for the borough E.C.; A. E. Symes, builder.

(STOKE NEWINGTON, N.).—Rebuilding 154-6, High Street; A. T. Batzer.

(FULHAM, S.W.).—Chapel, shelter and conveniences at North Sheen Cemetery for the B.C.; C. H. Gibson, Ltd., 509, London Road, Croydon.

(EALING, W.).—Printing works for King & Hutchings, Ltd., Uxbridge road; Hall-Jones & Dewhirst, architects, Ealing. Shops and business premises, Greenford Road; Marrable Bros., 60, Pretoria Road, E.11.

(PADDINGTON, W.).—Buildings, Cambridge Terrace, Edgware Road and Star Street; Marshall & Tweedy.

MALVERN.—Fire station for the U.D.C.; W. O. Thorp, surveyor.

MIDDLESEX.—Enlargement of Maria Grey Training College, Brondesbury, and Kilburn High School (£19,135) for the County E.C.; G. Godson & Son, Ltd., contractors, Pembroke Works, Kilburn Lane, W. Enlargement of Minchenden Secondary School, Southgate, for the county E.C. (£30,160); Albert Monk, contractor, Lower Edmonton, N.

MUSSELBURGH.—Houses (200); burgh surveyor.

NORTH RIDING.—Schools, Eston, Thornaby-on-Tees, and Clifton (York), for the county E.C.; director of education, Northallerton.

NORTHUMBERLAND.—Schools, Morpeth (£29,000), Gosforth (£32,000), and Seghill (£15,000), for the E.C.

OSWALDTWISTLE.—Senior school (520 places) for the E.C.; S. Wilkinson, county architect, 16, Ribblesdale Place, Preston.

OXFORD.—Extensions, Radcliffe Infirmary (£50,000) for the governors; secretary.

PETERBOROUGH.—Public baths (£40,000) for the T.C.; city engineer.

RADCLIFFE.—Houses (450); surveyor to U.D.C.

RAMSGATE.—Amusements park (£30,000), with electrical work, for the General Amusement Corporation, Ltd.; Granville Bradshaw, managing director.

RICHMOND (SURREY).—Houses (410) for the T.C.; borough surveyor.

ROCHDALE.—Operating theatre, Marland Hospital, for the T.C.; S. E. Morgan, surveyor, Town Hall.

RYE.—Re-erection of flour mill for A. Webb; Frank Marchant, architect.

RYTON.—Houses (50), Crookhill; Newcome & Newcome, 23, Eldon Square, Newcastle.

SEAFORD.—Conversion of Crouch House into municipal buildings for the U.D.C.; surveyor.

SEA HOUSES.—Harbour works (£25,000); Northumberland Sea Fisheries Committee.

SEDGLEY.—Alterations to cinema, Dudley Road; Darby and Fellows.

SHEFFIELD.—Premises, Fitzallen Market, for Montague Burton, Ltd., Hudson Road Mills, Leeds; John Middleton, Ltd., builders, 38, Bridge Street.

SHOREHAM.—Telephone exchange for H.M. Office of Works, King Charles Street, S.W.

SOUTHAM.—Houses (64) for the R.D.C.; H. L. Welch, surveyor.

SOUTH SHIELDS.—Flats (68) for re-housing scheme; borough engineer. Additions, Edinburgh House, Commercial Road; Armstrong, Ltd.

STAFFORDSHIRE.—Burnwood (400 places), Short Heath (400 places), and Wednesfield (350 places); F. A. Hughes, director of education, County Education Offices, Stafford.

STIRLINGSHIRE.—Municipal buildings for Denny and Dunipace, for the T.C.; burgh surveyor.

STOCKPORT.—Re-erection of corn mill, Princes Street, for William Loose & Co.

SUNDERLAND.—Alterations and extensions to Sunderland and Durham Institute for the Blind for the T.C.

SWANSEA.—Extensions, Girls' High School, Brynymor Crescent; borough architect.

THORNABY-ON-TEES.—Bank, Mandale Road, for the National Provincial Bank, Ltd., London.

TYNEMOUTH.—Shelters, the Plaza (£6,710); J. L. Beckett, borough surveyor.

WALLASEY.—Reconstruction of Winter Garden Theatre; Messrs. Milestone, contractors.

WALSALL.—Clearance scheme, Ann Street area; borough engineer.

WARRINGTON.—Houses (300) for the T.C.; borough surveyor. Premises for the Co-operative Society, Ltd., Cairo Street; Architect's Department, Co-operative Wholesale Society, Ltd., 113, Corporation Street, Manchester.

WELLINGBOROUGH.—Houses (238) for the U.D.C.; surveyor.

WHITEHAVEN.—Houses (500) for the T.C.; borough surveyor.

WORTHING.—Joint aerodrome for Worthing, Hove and Brighton Councils.

VERITYS "ASTON" MOTORS

You cannot do better than specify Veritys Motors for every requirement.

They are famed for economical running, long life and year after year reliability.

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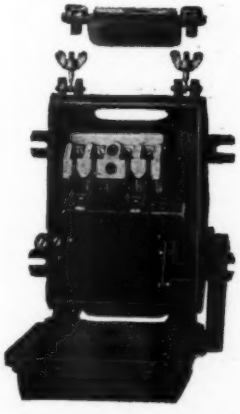
Telegrams: Verity, Rand, London. Cables: Verity, London.

TUCKER TELAC



The Main Switch

In an ordinary Q.M. & Q.B. Ironclad Switch the spring may be instrumental in giving just that necessary impetus to ensure rapid acceleration in the "Make" and "Break" movements, but in the event of the spring failing the switch would be quite useless.

It will be appreciated, therefore, that in order to guard against the possibility of spring failure

POSITIVE ACTION IS ESSENTIAL

Where a "Tucker" Ironclad Switch forms the Main Control Unit in an installation you have a Full Positive Action Switch with the assurance that no matter for what period the switch has not been operated it would still operate even if for some inexplicable reason the spring had failed.

Send for Folder S.9.

The TUCKER 14 Groups comprise:—

Tumbler Switches *Surface, Semi-recessed, Flush and Ironclad*	**Pear Switches**
	Ceiling Roses
	Counterweights
Switchplates	**Cut-outs**
Sockets and Plugs *Surface, Flush & Ironclad*	**Fuse and Distributing Boards** *in Teak and Iron*
Bell Pushes	**Ironclad Switches**
Iron and Wood Boxes	**Ironclad Fuses**
Lampholders	**Cooker Control Units**

Tucker TELAC

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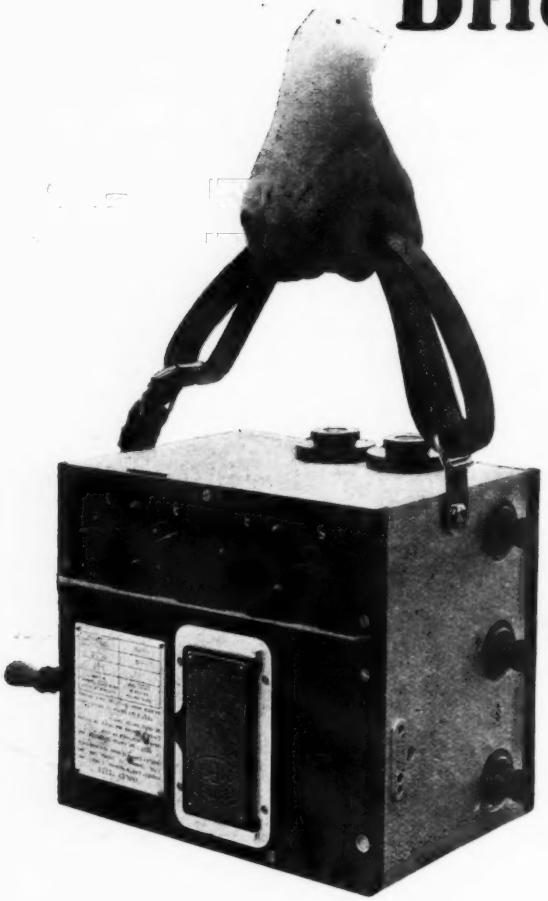
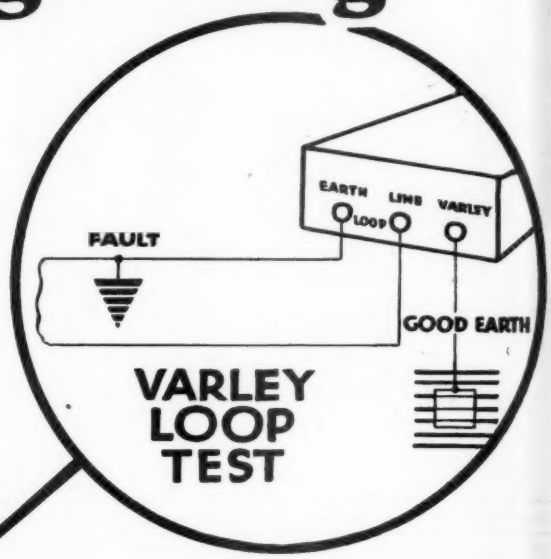
LONDON:	BELFAST:	GLASGOW:
223 D'Arblay St., W.1.	18, Scottish Temperance Bldgs.	221, St. Vincent St., C.2.

Additional Facilities on the Bridge Meg





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The BRIDGE-MEG Resistance Tester is now supplied in a special pattern which can not only be used :

(1) as a MEG to test insulation resistance,

(2) as a Wheatstone Bridge to measure conductor resistance,

but—

(3) as a Wheatstone Bridge with special connections to locate faults in cable or overhead lines by the Varley Loop method.

The VARLEY LOOP BRIDGE-MEG is the first instrument to provide these facilities in one compact, light, inexpensive unit.

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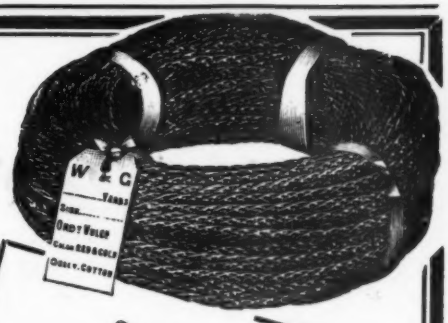
for all purposes to every Specification

FAVOURABLE PRICES
PROMPT DELIVERY
BEST BRITISH MANUFACTURE



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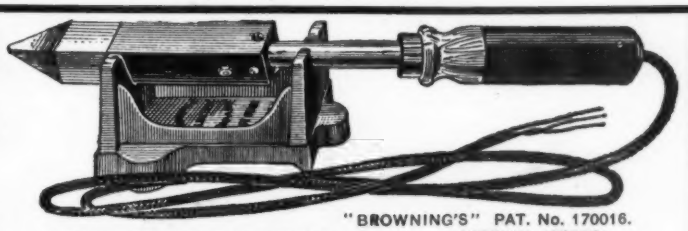
ALL SIZES, FOR ALL PURPOSES.
COMBINE **SPEED, CLEANLINESS** AND **RELIABILITY.**

TRY THEM and PROVE THEIR WORTH.

Guaranteed for SIX Months.
Illustrated Catalogue giving full particulars from Manufacturers.



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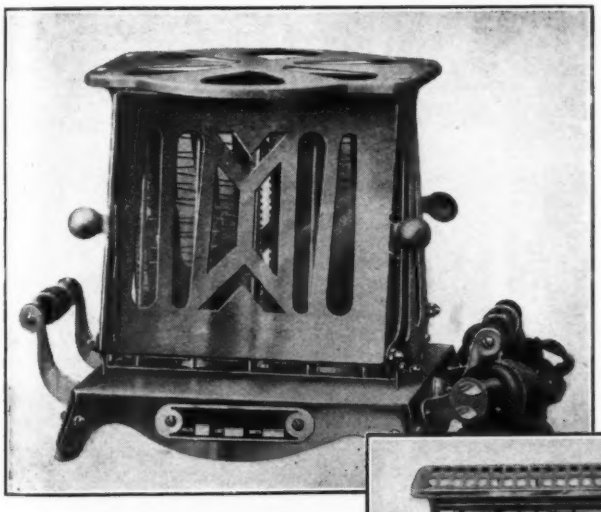
BROWNING'S ELECTRIC CO.,
Telephone No.: GRANGEWOOD 0801.
Tele. Address: "Electrocis, Eham, London."
IMPERIAL WORKS,
ST. MARTIN'S AVENUE,
EAST HAM, LONDON, E. 6.



Electric Turnover Toaster, nickel plated, 600 Watts
25/=

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Make 1931 an EDISWAN Toaster Year

The name "Ediswan" means a great deal to the buying public. It also means a great deal to you. Stage good window displays, and get your full share of Ediswan's goodwill. Typically British in reliability, Ediswan Toasters mean satisfaction for purchasers and no-trouble sales for you.

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CRYSELCO
OPAL TYPE
GASFILLED
MADE IN ENGLAND
CRYSELCO LAMPS
THIS IS THE SEASON OF GOODWILL
—and goodwill we extend to you at all times.
Your business grows only by the goodwill accorded to your customers every day during the 365 days in the year. We recommend that you make every day throughout the coming year "A CRYSELCO Electric Lamp Day."
Make a special feature of "CRYSELCO" Opal Lamps—the lamp with two skins.
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BRIGHTON: 59, Ship St. 'Grams: "Cryselco, Brighton." 'Phone: Brighton 5512.

BRISTOL: Paramount Chambers, Mitchell Lane, Victoria Street. 'Grams: "Cryselco, Bristol." 'Phone: Bristol 8069.

CARDIFF: 30, Charles St. 'Phone: Cardiff 7466.

GLASGOW: 172, Bath St. 'Grams: "Cryselco, Glasgow." 'Phone: Douglas 577.

LEEDS: 43, York Place. 'Grams: "Cryselco, Leeds." 'Phone: Leeds 27866.

LIVERPOOL: 22, Sir Thomas Street. 'Grams: "Cryselco, Liverpool." 'Phone: Bank 5310-11.

LONDON: Thanet House, 231-2, Strand, W.C.2 'Grams: "Cryselco, Estrand, London." 'Phones: Central 3016-7-8.

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Flue-Dust Collectors
catch
FINE DUST as well as COARSE GRIT

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6,720 lbs. dust collected during test period when 115.6 tons of coal consumed.

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16.52% larger than 90 mesh screen
74.35% less than 120 mesh screen
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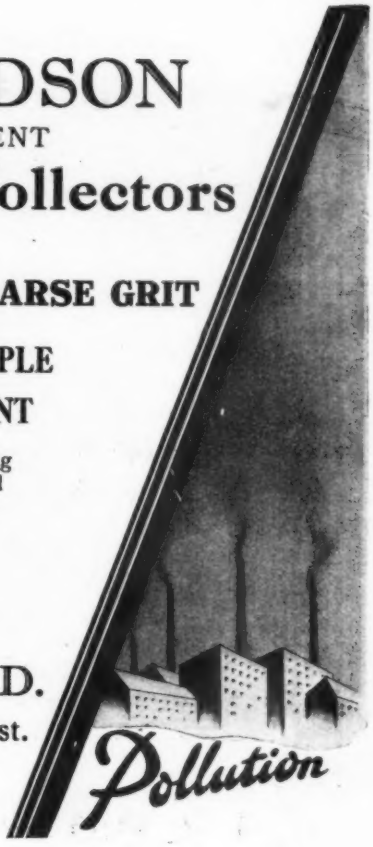

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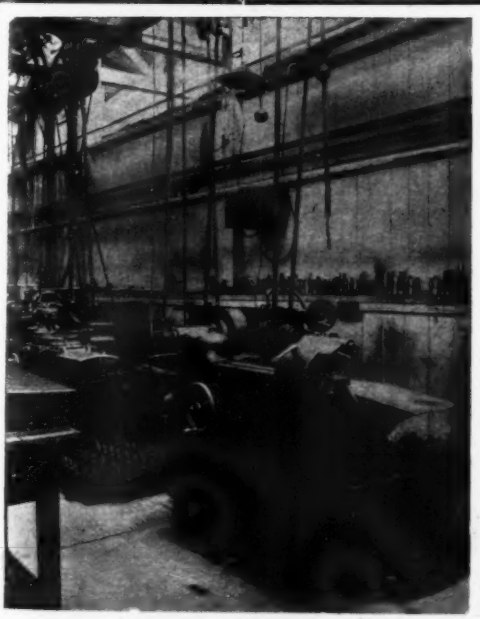
Feed your magnetic chucks from the A.C. mains through a

WESTINGHOUSE METAL RECTIFIER

WESTINGHOUSE Metal Rectifiers will supply direct current from A.C. mains without the disadvantages of rotary conversion, chemical action or valves.

They are made in sizes suitable for any requirements from microwatts to kilowatts.



Grinding machines with magnetic chucks operated from A.C. Supply by means of Westinghouse Metal Rectifiers.

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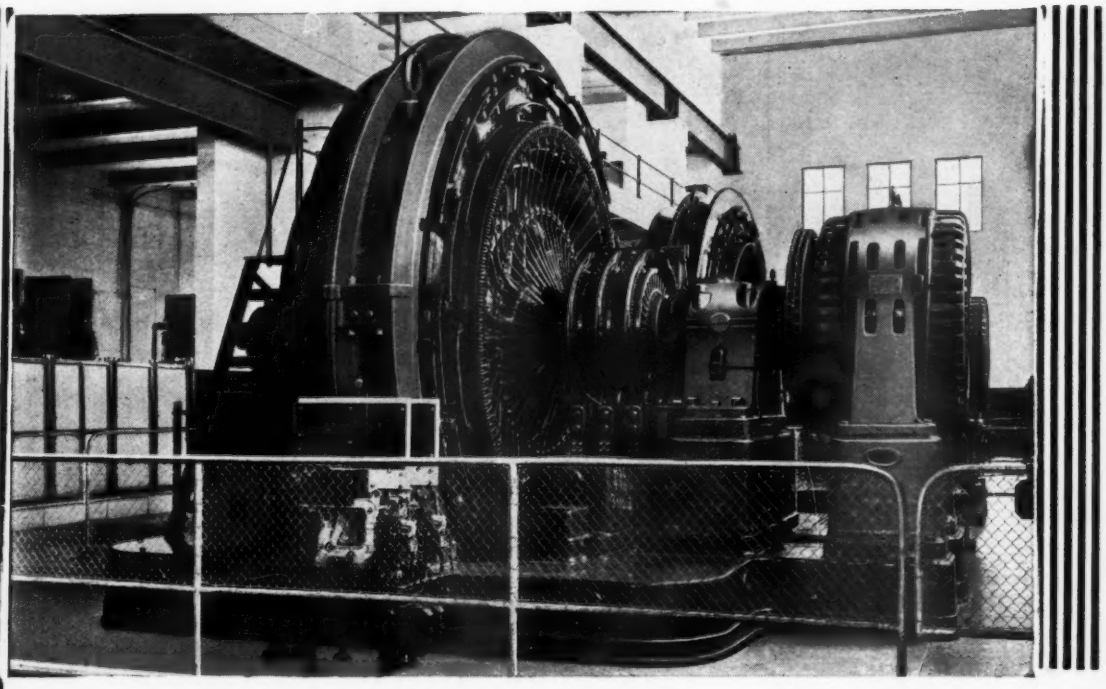
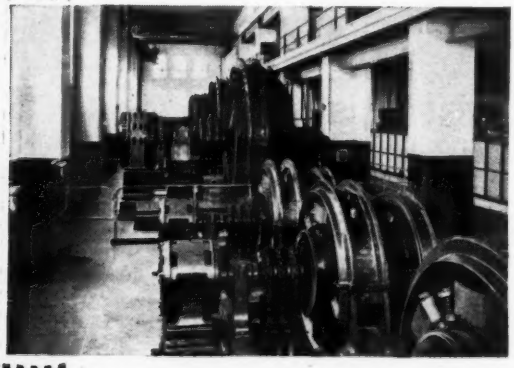


12,000kW of Metrovick Rotaries

The New South Wales Government Railways and Tramways, to ensure reliability in operation, have included in the equipment of their Prince Alfred Substation at Sydney, the following "Metrovick" Rotary Converters.

The top illustration gives a near view of the 4500kW Sets at the Prince Alfred Substation, and below a general view of the Converter floor with the 1000kW Sets in the foreground.



Converting the system — 6600 Volts 3 phase 50 periods through

TWO 4500kW

THREE 1000kW

"METROVICK" ROTARIES

to 1500 Volts D.C. for RAILWAY TRACTION

to 600 Volts D.C. for TRAMWAY TRACTION

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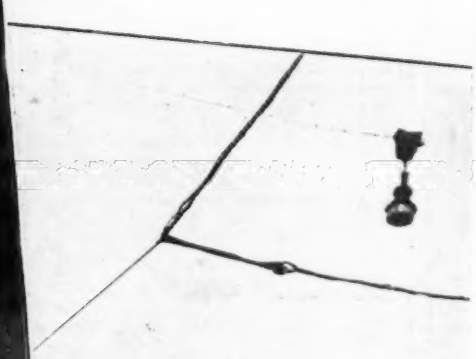
Revo

makes LIGHT of NIGHT at LIVERPOOL



The "Killdark" Fitting.

"Revo"

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STANDARDS
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ANOTHER splendid example of scientific street lighting by means of Revo fittings is shown in the above day and night pictures of Castle Street, Liverpool.

Diversity factor mid span illumination to maximum illumination —1.6 to 1. Consumption—31 watts per lineal yard.

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G.E.C.

XMAS 1930

NEW YEAR 1931

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Branches throughout Great Britain and in all the principal markets of the World

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OF THE WEEK PREVIOUS TO ISSUE.

The ELECTRICAL REVIEW is the recognised Medium of the Electrical Trades, and has BY FAR THE LARGEST CIRCULATION of any Electrical Industrial Paper in Great Britain.

NOTICE

Advertisements for classified columns **MUST** reach us by

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SITUATIONS VACANT.

If letters are not to be delivered to certain firms or individuals (if known), instructions to that effect should be sent to the Manager of the ELECTRICAL REVIEW, who will do his best to carry out such instructions. Letters of applicants cannot in such cases be returned to them, nor can the names of Advertisers using a number in any way be disclosed.

Important to applicants for Situations Vacant—

ORIGINAL TESTIMONIALS

should *NEVER* be sent with applications.

COUNTY BOROUGH OF BRIGHTON.

Electricity Department.

APPOINTMENT OF DISTRIBUTION ENGINEER.

APPLICATIONS are invited for the position of Distribution Engineer on the staff of the Brighton Corporation Electricity Department from engineers having organising ability and experience in e.h.p. distribution, both underground and overhead, together with an intimate knowledge of low-tension a.c. and d.c. systems. Experience in change-over schemes from d.c. to a.c. supplies will be of advantage.

Salary in accordance with Grade 3, Class "G," of the National Joint Board Schedule of Salaries for Technical Engineers (present approximate value £559 per annum).

Applications, giving the names of three persons from whom references can be obtained, and stating how soon duties could be taken up if appointed, should be forwarded to the undersigned not later than January 7th, 1931.

W. N. C. CLINCH,
Engineer and Manager.

Electricity Works,
North Road, Brighton. 1934

SITUATIONS VACANT.—*Continued.*

GRIMSBY CORPORATION.

Electricity Department.

MAINS ASSISTANT.

APPLICATIONS are invited for the post of Mains Assistant. The duties include responsibility under the Distribution Engineer for the extensions to and maintenance of a section of the transmission and distribution system.

Applicants must have a sound knowledge of alternating and direct current systems of supply, and be competent to carry out distribution works to the best advantage.

Salary in accordance with the National Joint Board Schedule, Grade 8, Class E, at present £310 per annum.

Applications, stating age, distribution experience, and enclosing copies of testimonials, to be forwarded as early as possible to the undersigned.

S. R. WINDLE,
Borough Electrical Engineer.

Moss Road, Grimsby. 1913

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

Important to applicants for Situations Vacant—

ORIGINAL TESTIMONIALS

should *NEVER* be sent with applications.

DISTRIBUTION Engineer wanted for supply company near Stockport. Applicants to state age, and full details of experience, &c., and submit copies of recent testimonials. Salary £250 per annum.—1814, Electrical Review, 4, Ludgate Hill, London.

INSTRUMENTS.—Test Room Assistants required for North London factory; must be conversant with the testing of inductances and condensers.—State technical qualifications, age and salary required, to 1929, Electrical Review, 4, Ludgate Hill, London.

J. H. TUCKER & Co., Ltd., 22/23, D'Arblay Street, W.1, have a vacancy for an experienced London Representative.—Apply in writing, stating age, experience, area covered and remuneration required. 1918

LIFT Electrician wanted, to fill position on the technical staff of Wm. Wadsworth & Sons, Ltd. Applicant should have had previous experience in a similar position and be familiar with the various lift control systems, including variable voltage control. This is a good post, affording progressive opportunities to the right man.—Apply by letter, stating age, experience, and salary required, to F. E. Ryder, c/o Wm. Wadsworth & Sons, Ltd., High Street, Bolton, Lancs. 1885

PLUMBER-Jointer required for 11,000-volt, 2,750-volt and 400-volt, three-phase, 50-period mains. State age and experience. Joint industrial rate, No. 9 area, 1s. 7½d. per hour. —Applications should be marked "Plumber-Jointer," addressed to the Chief Engineer, The Oxford Electric Co., Ltd., Russell Street, Oxford. 1895

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SITUATIONS VACANT.—*Continued.*

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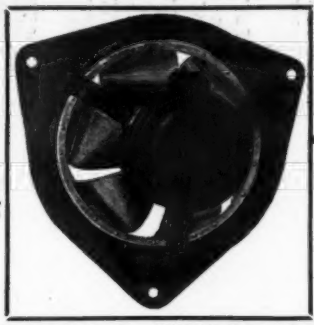

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A review of this book says:—"This booklet should be in the hands of every engineer concerned with rural electrification schemes, whether on the supply or installation side, to whom it will prove not only of interest but also of value. The commonsense way in which electrical safety problems are discussed in this publication is decidedly refreshing after the complacent attitude generally adopted by writers and engineers towards these questions, even by those—to quote the Chief Electrical Inspector of Factories—' who by virtue of their responsible position with regard to the safety of others, ought to be fully cognisant of the facts.' "

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THE ELECTRICAL REVIEW, LIMITED, 4, Ludgate Hill, London, E.C.4.

THE . . .

Electrical Trades Benevolent Institution

Founded 1905.

THE OBJECTS OF THE INSTITUTION

are to

GRANT PENSIONS and to DISPENSE TEMPORARY RELIEF to DESERVING AND NECESSITOUS PERSONS WHO ARE OR HAVE BEEN ENGAGED IN THE ELECTRICAL TRADE IN THE UNITED KINGDOM AS EMPLOYERS, MANAGERS, TEACHERS, OR ON THE ENGINEERING, DESIGNING, DRAWING, SALES OR OFFICE STAFF, or in ANY OTHER SIMILAR CAPACITIES, or to THEIR DEPENDENTS.

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By special arrangement with our printers we are pleased to announce a reduction in prices of reprints (without setting) of advertisements appearing in this Journal. The reduction for large quantities is considerable.

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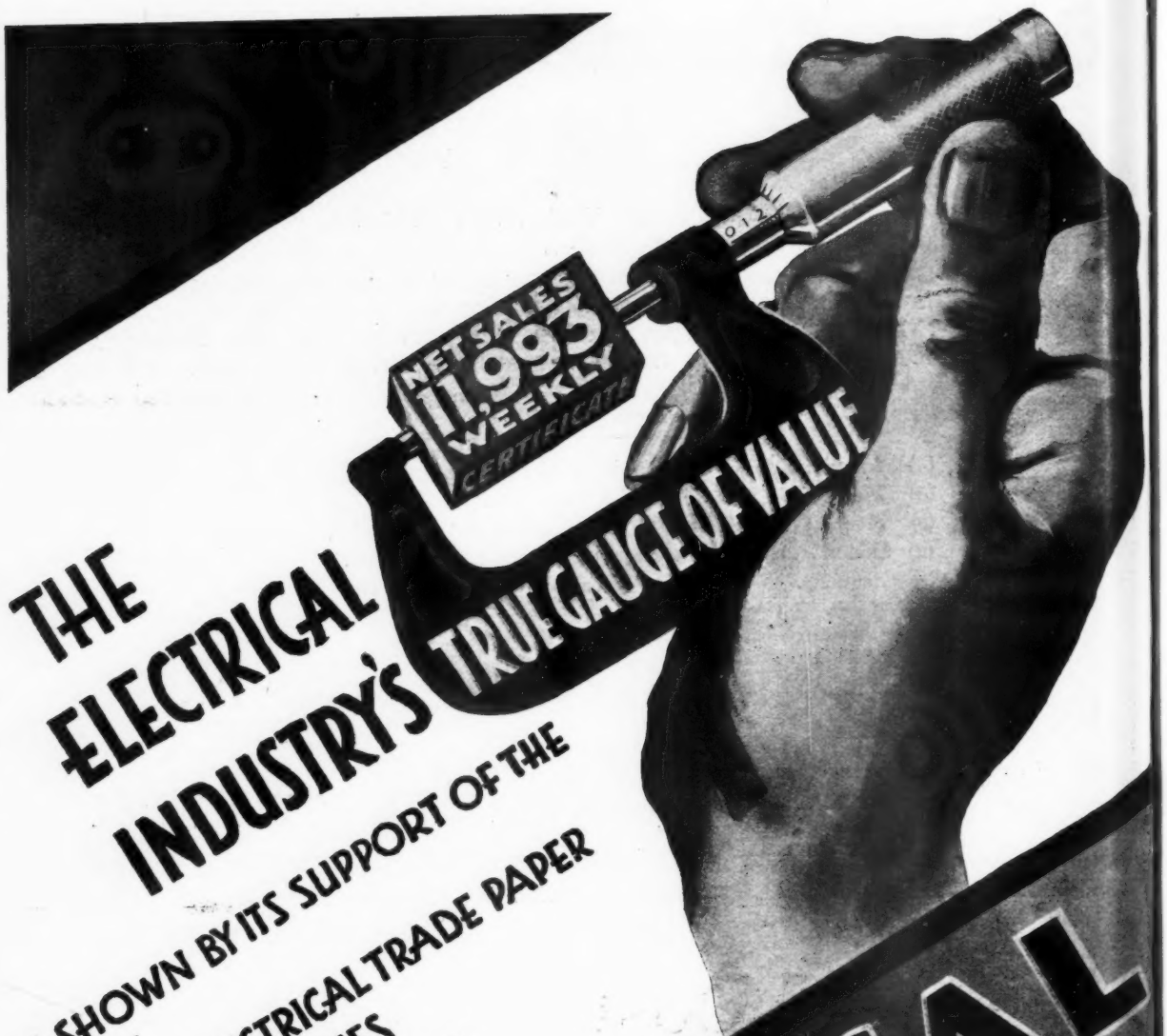
'Phone: Central 5871.

Advertisements indexed on this page will be found on Sup. 13.



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CALLENDER'S CABLE & CONSTRUCTION CO. LTD.
Hamilton House, Victoria Embankment, London E.C.4.
Telephone: Central 5241 Telegrams: Callender, Fleet, London.

This is an actual photograph, not a composite picture.

ONE OF THE J.&P PAGES

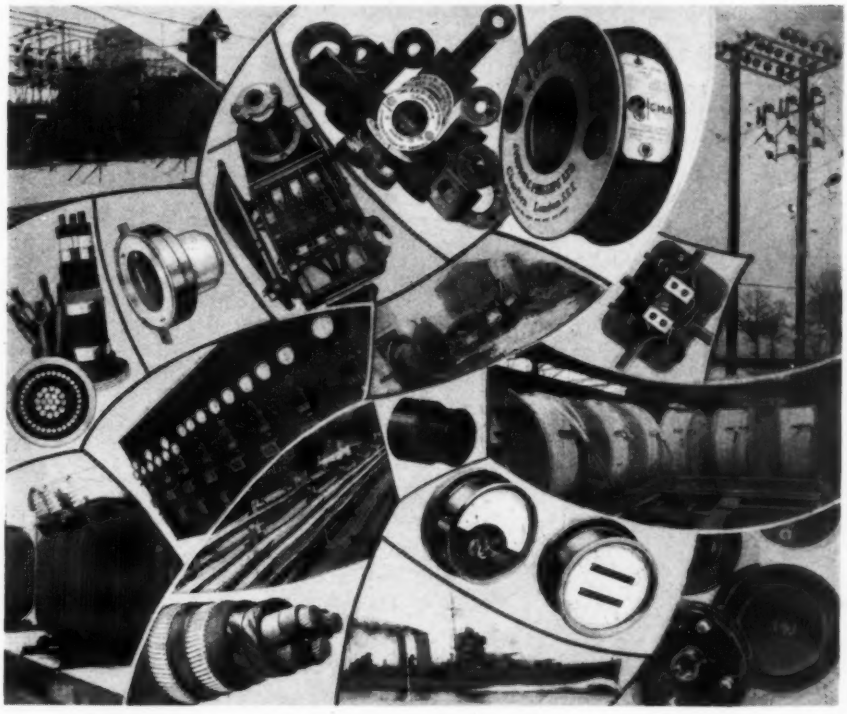
GOOD THINGS FOR XMAS

These are only a few of the good things we wish you for Xmas—we wish you, in fact, all you could wish yourselves.

It hasn't been an easy year for anybody, but we in the Electrical Industry have, comparatively speaking, a lot to be thankful for.

For our own part, we hope that by value and service we have done something towards putting a share of the good things of life in the way of those who have been our friends and customers throughout 1930.

ONE OF THE J.&P. PAGES



GOOD THINGS FOR THE NEW YEAR

Here again are just a few of the good things which we hope will help to make 1931 the best year yet for a still wider circle of J. & P. adherents all over the world.

We hope our customers will not object to being called adherents, we call them that because we want them to stick to us—and they generally do.

J. & P. Cables, Line Material, Transformers and Switchgear will be maintained throughout 1931 at the highest standard of quality and value.

JOHNSON & PHILLIPS, LTD.
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Light-weight Ohmmeters with Generators.
1000 volts : 1000 megohms.
1000 volts : 2000 megohms.

The use of Bakelite bushings for insulating terminals, etc., makes a high range Ohmmeter indispensable.

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Prescot Meters comply with the British Standard Specification No. 37/1929 for Electricity Meters.

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LEIPZIG: Einkaufsstelle des Borsenvereins der Deutschen Buchhandler. Gerichtsweg 26, Postfach 274/5. Lib. A. Twietmeyer Gellerstr. 14.

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MADRID: Editorial "Voluntad" S.A. Serrano 48.

MELBOURNE: Tait Book Co., 39, Queen Street; Gordon & Gotch, Queen Street; "Australasian Electrical Times," 312, Flinders Street; Commonwealth Magazine Agency, 294, Little Collins Street: Jervis Manton, Nicholas Building, 37, Swanston Street; H. A. Goddard, Ltd.

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MOSCOW: Mezhdunarodnaya Kniga Kuznetskij-Most. 18.

NANCY: Librarie Berger Levrault, 18, Rue des Glacis.

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NEW YORK: Crowley, The Magazine Man, Inc., 511, E.164th Street.

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PRAGUE (Czechoslovakia): Fr. Rivnac Librarie Na Prikope 24; F. Topic. Orbis Publishing Co., Fochora 62. xii.

ROME: Ditta P. Maglioni & C. Strini, 88, Via Due Macelli.

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SIMLA: Thacker, Spink & Co.

SYDNEY: Tait Book Co., 273, George Street: Gordon & Gotch, Pitt St., Commonwealth Magazine Agency, 183, Pitt Street; H. A. Goddard, Ltd., 255a, George Street.

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TOKYO: Maruzen Co., Ltd., 6, Nihonbashi-Tori-Nichome. Barth Shokai, Marunouchi Building Kojimachiku; Sanseido Shoten, I. Torijimbocho, Kanda.

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TURIN: S. Lattes & Co., 3, Via Garibaldi.

WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

ZURICH: E. Rascher & Cie. Rathausquai 20.

Illustrations!

BLOCKS intended for use in the Advertisement Pages of the "Electrical Review" should not exceed 120 screen.

OFFICIAL NOTICES.

Latest time for receiving, 5 p.m. Tuesday.

COUNTY BOROUGH OF SOUTHEND-ON-SEA.

General Stores.

TENDERS are invited for the supply of the General Stores set out hereunder for a period of 12 months, commencing April 1st, 1931.

Specification, conditions and forms of tender may be obtained from the Borough Electrical Engineer and Manager, Electricity Works, London Road, Southend-on-Sea.

Sealed tenders must be returned to the undersigned not later than January 21st, in the envelope endorsed "Tender for Stores" provided for the purpose.

A—Meters and Instruments.
B—Electric Fittings.
C—Cables and Steel Conduits.
D—Joint Boxes.
E—Building Materials.
F—Stoneware Conduits.
G—Engineer's Stores.
H—Ironmongery.
I—Tools.
J—Welding Materials.
K—Cleansing Materials.
M—Lead and Solder.
O—Jointing Materials.
P—Fuel, Oil and Coke.
Q—Diesel Lubricating Oil.
R—Diesel Engine Spare Parts.

H. J. WORWOOD, Town Clerk.

Municipal Buildings,
Southend-on-Sea. 1894

OFFICIAL NOTICES.—*Continued.*

HESTON AND ISLEWORTH URBAN DISTRICT COUNCIL.

Electricity Department.

THE Heston and Isleworth Urban District Council invite Tenders for the following electrical supplies required by the electricity department for a period of one year from the 1st day of April, 1931:—

House Service Cut-outs.
Joint Box Compound.
Cable Troughing Compound.
Street Lamps Brackets.
Meter Boards.
Cut-out Boards.
Service Joint Boxes.
Tin.
Plumbers Metal.
Solder.
Blackley Tape.
White India Tape.
Pure Rubber Tape.

A form of tender and specification may be obtained upon application in writing to the Engineer and Manager, Electricity Department, No. 11, Staines Road, Hounslow, to whom all drawings or samples of apparatus or goods tendered for should be forwarded.

Tenders are to be enclosed in sealed envelope, marked on the outside "Electrical Supplies," and must be delivered to the Clerk to the Council, Council House, Hounslow, not later than 12 noon on Friday, January 9th, 1931.

The Council do not undertake to accept the lowest or any tender.

By Order,
H. J. BAKER,
Clerk to the Council.

Council House, Hounslow.
December, 1930. 1922

BOROUGH OF BRIDLINGTON.

Electricity Works—Brett Street.

THE Council invites Tenders for the following work:—

Specification No. 9.—11-kV and Low Tension Cables, Boxes and Roadwork.
Specification No. 10.—11-kV Ring Main Switchgear, Transformers and Equipment for Three Kiosks.

A copy of these specifications can be seen and obtained from the offices of Messrs. Kennedy & Donkin, 8, Broadway, Westminster, S.W.1, on and after Monday, December 22nd, upon payment of a deposit of £2 2s. for each specification (cheque, postal or money order). An additional copy of either specification can be obtained upon payment of a deposit of £1 1s. These deposits will be returned after the receipt of a bona fide tender and on the return of the specification.

Tenders on the prescribed form, enclosed in sealed envelopes and addressed on the outside:—

"Electricity Supply, Cables, Tender to Specification No. 9."
"Electricity Supply, Switchgear and Kiosks, Tender to Specification No. 10."

must be delivered at the office of the undersigned not later than 10 a.m. on Monday, January 19th, 1931.

The Council do not bind themselves to accept the lowest or any tender.

GEORGE MELVIN, ESQ.,
Town Clerk.

Town Hall,
Bridlington.
December, 1930. 1906

BARKING TOWN URBAN DISTRICT COUNCIL.

Electricity Department.

THE above Council are prepared to receive tenders for the supply, delivery and erection of

SUB-STATION SWITCHGEAR PLANT.

Specification and form of tender may be obtained upon application (not later than 1st January, 1931) to Mr. W. E. Kidner, A.M.I.E.E., Electrical Engineer, Ripple Road, Barking, on payment of a fee of one guinea, which will be returned on receipt of tender. Additional copies may be obtained on payment of a fee of one guinea, which will not be returned.

Tenders endorsed "Switchgear" and addressed to the undersigned, must be delivered not later than 5.0 p.m., on Monday, 12th January, 1931.

The Council do not bind themselves to accept the lowest or any tender, and the successful tenderer will be required to enter into a contract prepared by the undersigned.

S. A. JEWERS,
Clerk to the Council.

Public Offices, Barking.
December 11th, 1930. 1900

(*Continued on Sup. 24*).

S. G. LEACH & CO. LTD.
London Wall 3840 (4 lines).

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To Wholesalers and Contractors!

KEEN BUYERS

should ask for our Price List of Vulcanized India Rubber, Tough Rubber and Lead Covered Cables. V.I.R. Cables up to 61/.103 DELIVERED FROM STOCK. 600 megohm.

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ELECTRICAL ENGINEERS & MANUFACTURERS.
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"MEGO-METER" INSULATION TESTING SET.

Type D.
£10 - 10
LIST PRICE.

Type DA.
£14 - 10
LIST PRICE.

Both Types suitable for Insulation Testing on A.C. or D.C.
Type D can be used as Voltmeter on D.C.
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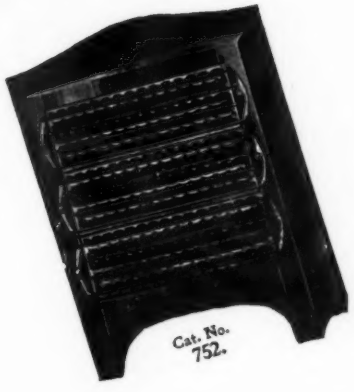
ASK YOUR WHOLESALER
FOR DETAILS, or
THE
Electrical Equipment & Carbon Co., Ltd.,
107, 109, 111, NEW OXFORD STREET, LONDON, W.C.1.



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Vitreous Enamelled in the following colours:—
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The superior quality of our Electric Fires is already well known to you. This superiority is incorporated in our NEW CAST FIRES together with an excellent Vitreous Enamelled Finish, at a much LOWER price. A fire of this description has long been required by your public. You can now satisfy them with one, worthy of the name "JACKSON."

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Telephone: SLOANE 6248 (3 lines). Telegrams: "COOKELEC, PHONE, LONDON," Works: LUTON, BEDS.

OFFICIAL NOTICES.—(*Cont. from Sup. 22.*)

PLYMOUTH CORPORATION.

THE Plymouth Corporation is prepared to receive tenders for :—

One 15,000-kW Turbo Alternator with condenser auxiliaries, &c.

Specification and form of tender may be obtained from the City Electrical Engineer, Armada Street, Plymouth, before December 31st, 1930.

Sealed endorsed tenders to be delivered to the undersigned not later than Saturday, January 10th, 1931.

The Corporation does not bind itself to accept the lowest or any offer.

(Signed) R. J. FITTALL,
Town Clerk.

Municipal Buildings, Plymouth.
December 15th, 1930. 1904

BARKING TOWN URBAN DISTRICT COUNCIL.

Education Committee.

THE above Authority invite tenders for the Electric Light Wiring and Fittings at the Eastbury School.

Plans can be seen, and specification and form of tender obtained at the office of the Authority's Architect, Mr. C. J. Dawson, F.R.I.B.A., Clock House Chambers, Barking, between the hours of 10 a.m. and 4 p.m., upon depositing a cheque for £3 3s. which will be returned upon receipt of a bona-fide tender.

The contractor whose tender is accepted will be required to abide by the Fair Wages Clause and to provide an approved surety for the due performance of the contract.

Tenders, enclosed in sealed envelopes, endorsed "Tender for Electric Lighting Installation, Eastbury School," to be delivered to the undersigned not later than 12 noon on Tuesday, December 30th, 1930.

The lowest or any tender will not necessarily be accepted.

J. COMPTON,
Director of Education.

Education Offices, Barking.
December 18th, 1930. 1930

SEAL PADLOCKS
FOR PRE-PAYMENT METERS
TOURTEL MFG. CO., 48, Uxbridge Road, Ealing, London, W.5.

Mopump
RHODES, BRYDON AND YOUATT, LTD., STOCKPORT.
Saves space; saves time and cost fixing; pumps maximum quantity for minimum current.
Send for List M116.
Advice and Estimate free.

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RYDE AVENUE, HULL.
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Manufacturers of every description of Slate and Marble Work for Electrical Purposes.

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MILLWALL DOCKS, LONDON, E.14.
PURE TAPE AND STRIP, &c., &c.
HOOPER'S Vulcanised India-Rubber Cables for Electrical Work maintain the highest quality, and their durability has been proved.
Telegrams : LINEAR, London. Telephone : Mansion House 6626.

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MICA FOR INSULATION.
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Advertisements are inserted under this heading at 14s. per inch.

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All instruction is by correspondence from text-books specially prepared by many experts for tuition by post.

Prospectus post free from
INTERNATIONAL CORRESPONDENCE SCHOOLS, LTD.,
55, International Buildings, Kingsway, London, W.C.2.
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35, Temple Bar House, London, E.C.4.
(Founded 1917.) 1780

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HOME COURSES for A.M.I.E.E. Electrical, Switchboard, Sub-station, Maintenance and Charge Engineers. Also in Wiring, Mathematics and Battery Charging.
ELECTRICAL TRAINING ONLY. Prospectus post free.
TECHNICAL ENGINEERING COLLEGE,
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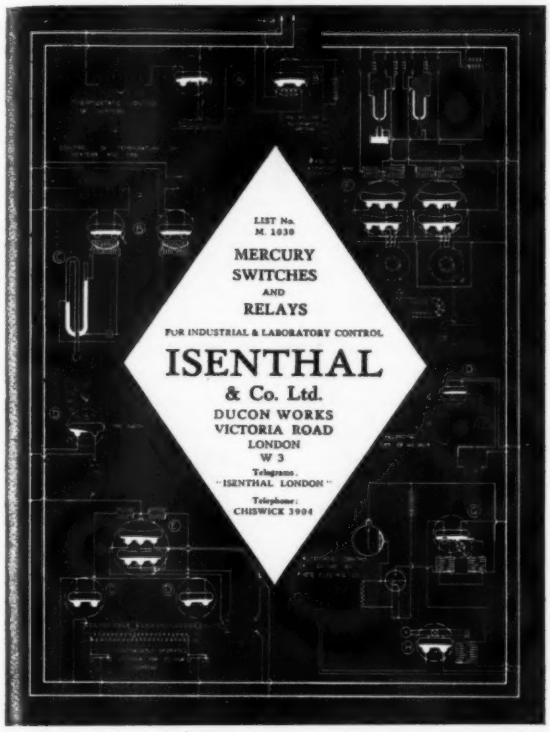
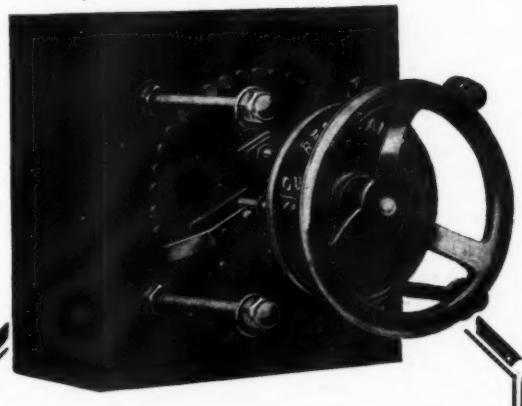
Principal : W. S. Ibbetson, B.Sc., A.M.I.E.E., M.I.Mar.E.

NOTICES RELATING TO PATENTS.

THE owner of Patent No. 284,528, "An Improved Automatic Electric Circuit Breaker," is desirous of entering into arrangements by way of licence or otherwise on reasonable terms for the purpose of exploiting the same and ensuring its full development and practical working in this country.—Full particulars from Edwards & Co., Lincoln House, 296/303, High Holborn, W.C.1. 9607

MERCURY SWITCHES





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You cannot do better than to write for the Cressall Regulator Catalogue which deals with a wide range of models suitable for every regulating purpose. Cressall Regulators are soundest in design and highest in quality of materials and workmanship and . . . . prices are particularly keen! Ask us to quote you for your next needs.

Our illustration shows a Back-of-Board type Regulator with ventilated protected resistance and 5 in. diameter Nickel Plated Handwheel and Dialplate ready for switchboard mounting.

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The most perfect Transmission lines are:—

JOHNSONS'
High Conductivity Hard Drawn Copper Wire.

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RICHARD JOHNSON & NEPHEW LIMITED,
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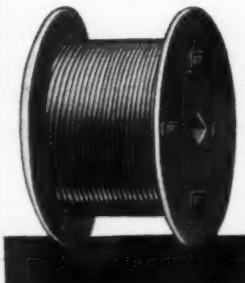

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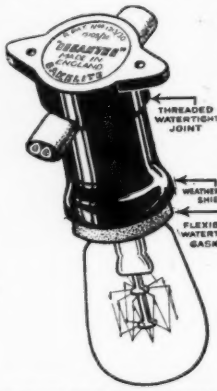

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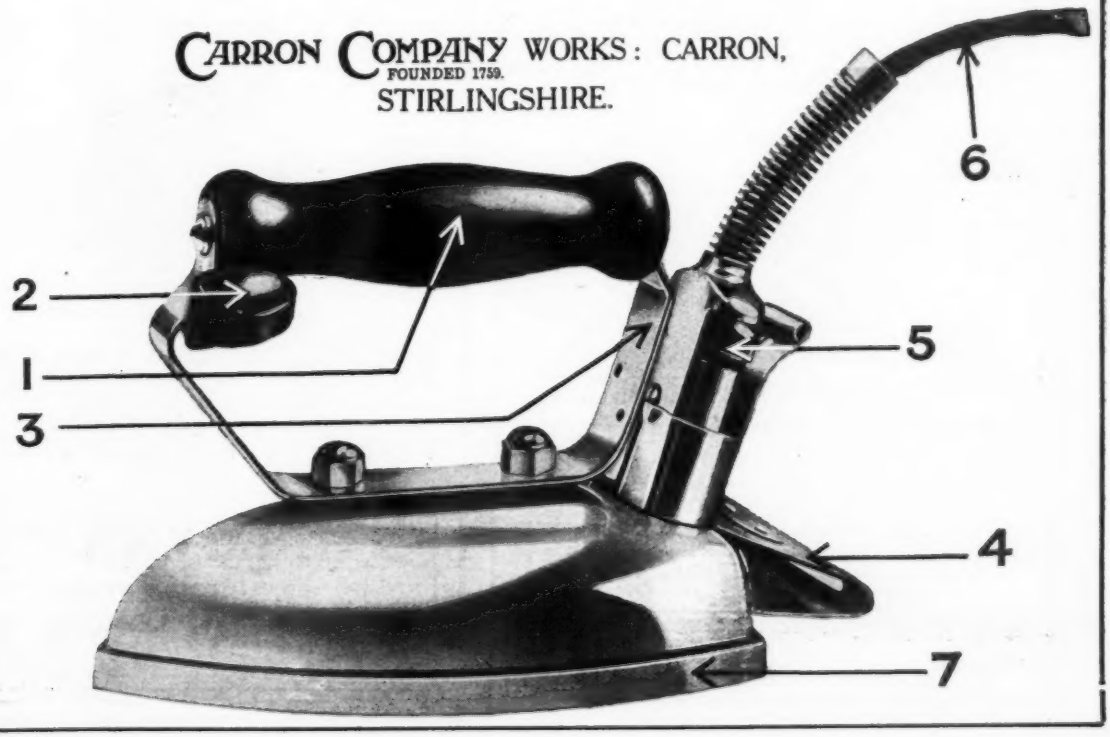

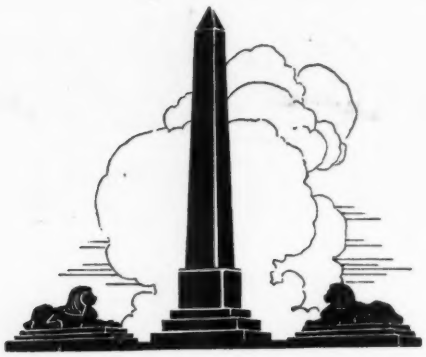

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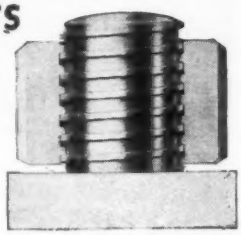

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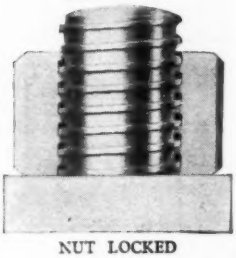

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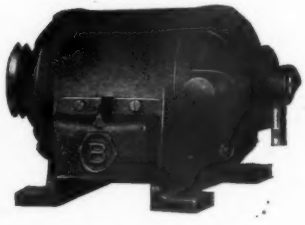

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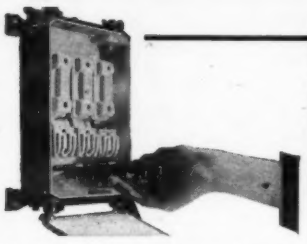

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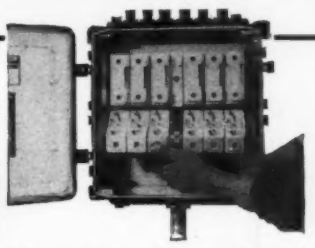

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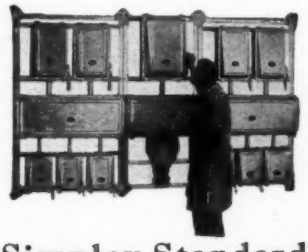

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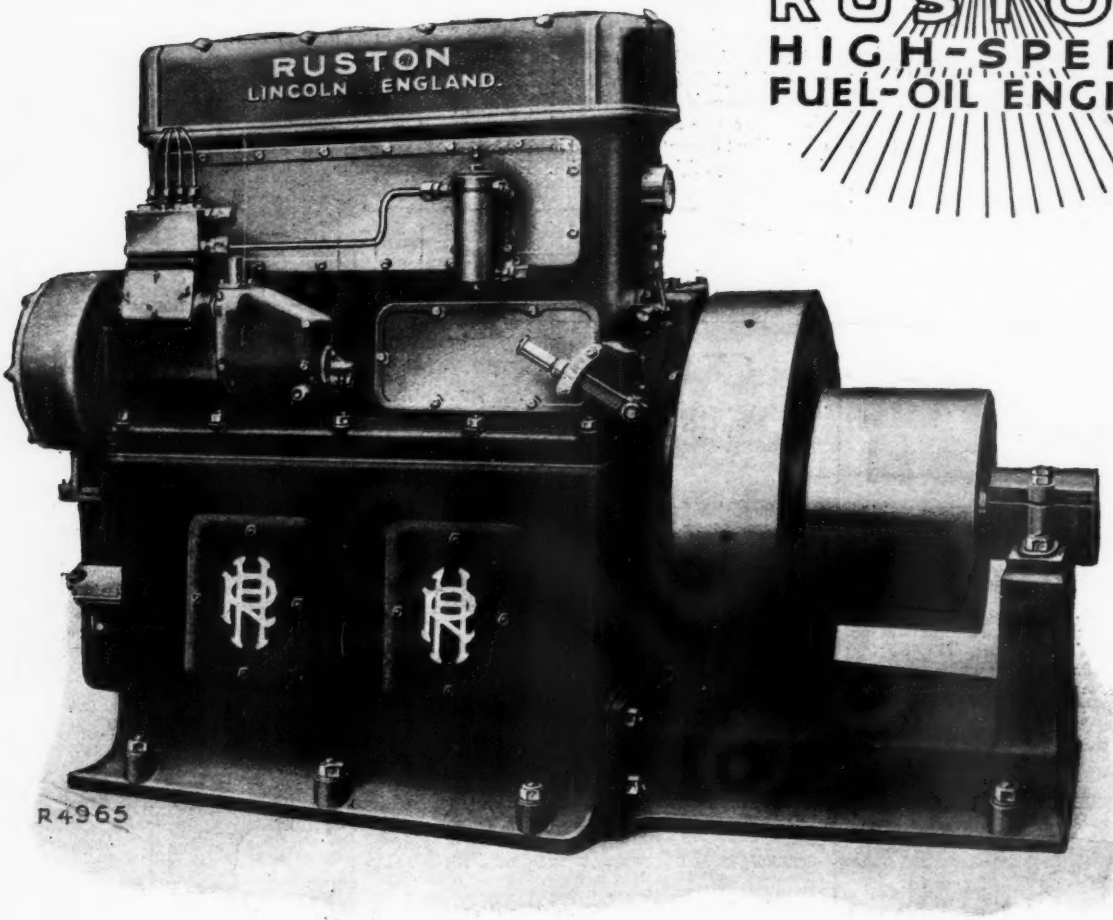

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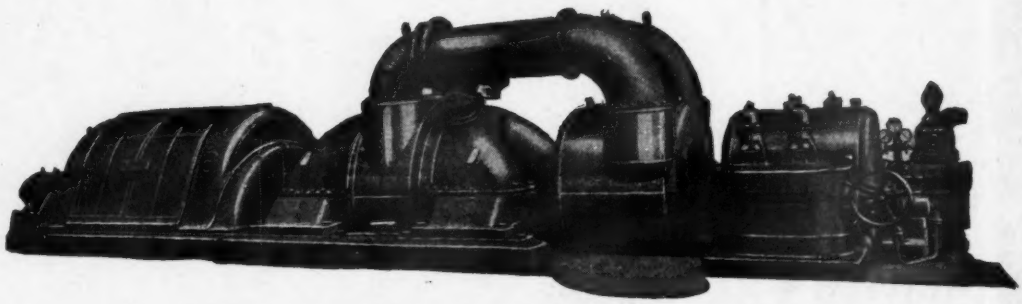

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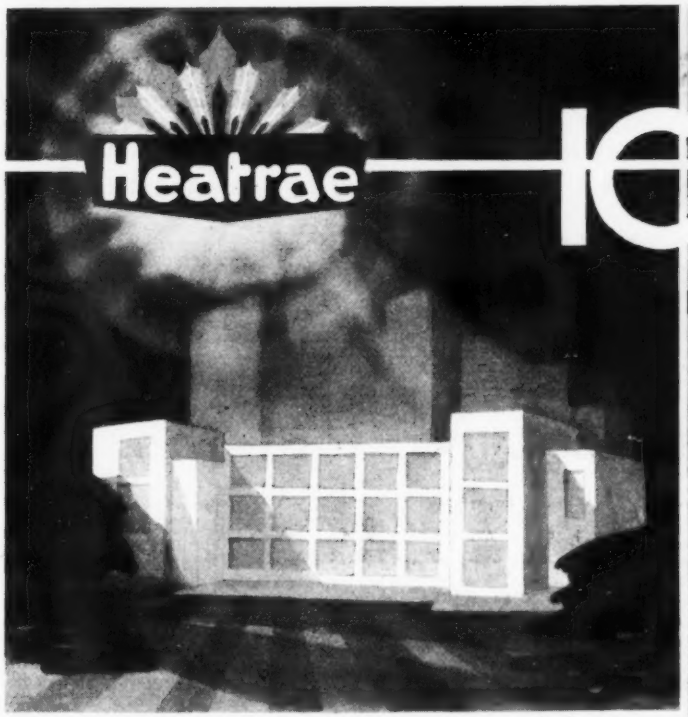

1931

At the close of another successful year "Heatrae" gratefully acknowledge the whole-hearted co-operation given by all old friends, both on their staff & in the Trade, & to all new friends, a typical "Heatrae" welcome.

CHEERS!

To All Friends Old and New

A Happy New Year

ELECTRIC FIRES, LTD., HEATRAE WORKS, NORWICH.

EMI FANS EMI

AND

SMALL MOTORS.

CEILING FANS

(SHIP-TYPE).

SLOW SPEED.

For D.C. and A.C.

This fan is fitted with 2 to 4 wood or aluminium blades.

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USED FOR FUSE WIRES, CABLES, AND WIRES of all Descriptions.

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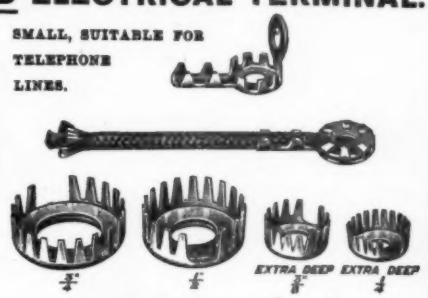

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D.C. Ratchet-type, foolproof
STARTERS
for dirty, dusty situations, &c.

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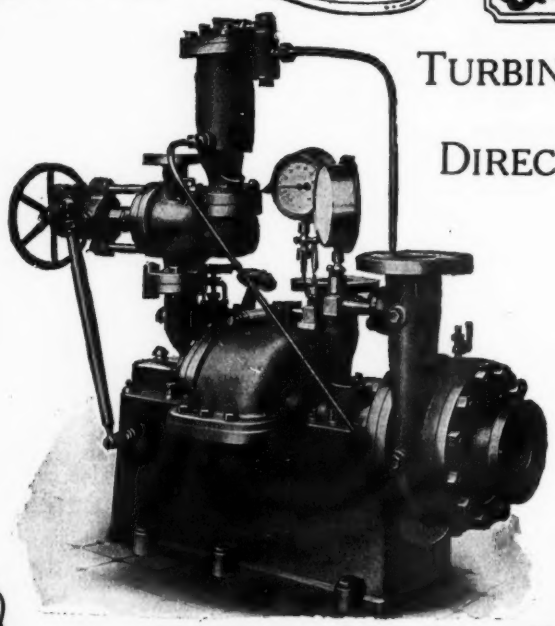

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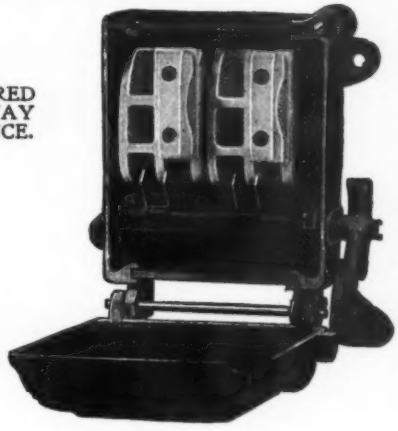
- D.P. & T.P., with and without fuses.



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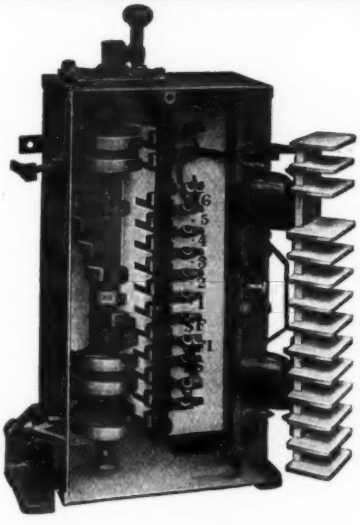

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KEEN prices are the natural corollary of competition; but keen prices often mean poor materials and inferior workmanship. The result is that the so-called keen price becomes a very high one as the maintenance charges occur.

"EMB" controllers are offered at keen prices, but with this difference—they are obtained not by sacrificing reliability but by using modern equipment and improved methods of manufacture.

"EMB" controllers can be depended upon to stand up to heavy duties.

STANDARD SIZES.

FOR USE WITH **A.C.** SLIP RING MOTORS.

MAX. H.P.	MAX. ROTOR CURRENT	MAX. STATOR CURRENT	No. OF POINTS	TYPE
10	65	65	4	10 A 10
19	65	65	5	15 A 15
50	85	85	7	15 AB 20
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110	160	160	8	50 A 30
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FOR USE WITH **D.C.** SERIES WOUND MOTORS.

MAX. 110	HORSE 220 VOLTS	POWER 400/600	No. OF POINTS	TYPE
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to all

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Best Wishes for

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New Year

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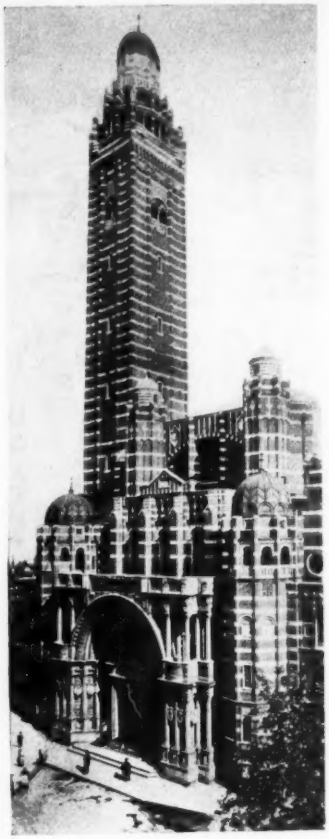

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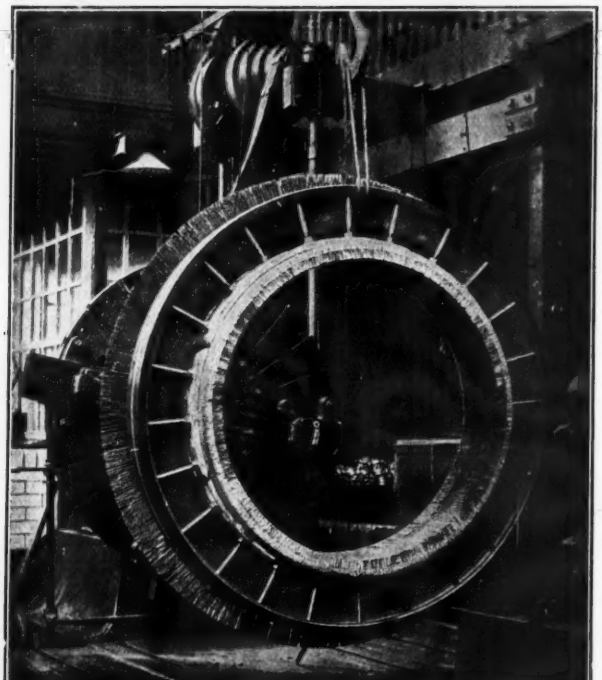

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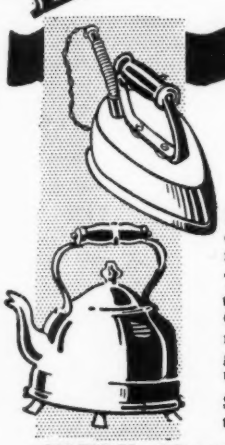

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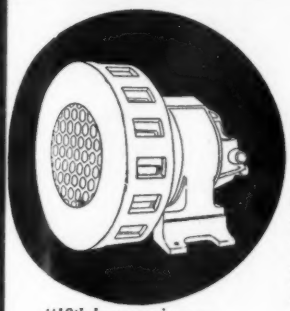

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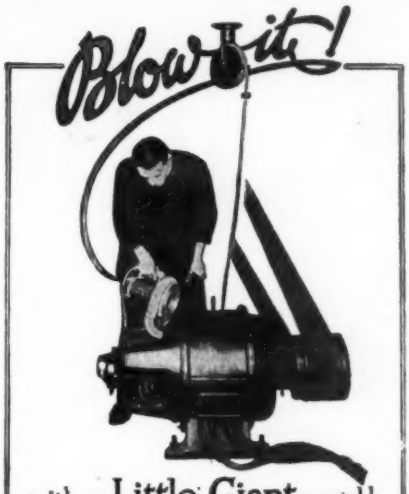

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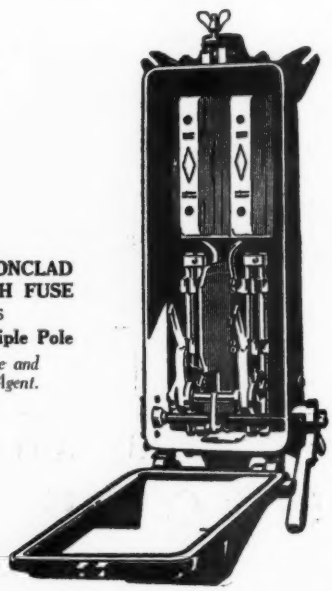

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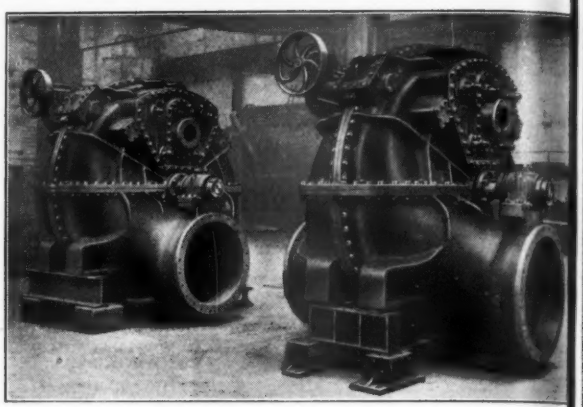

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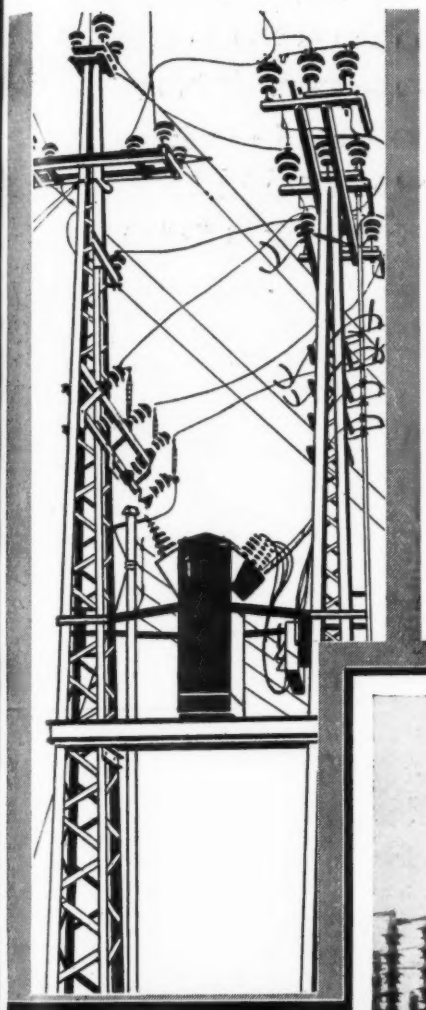

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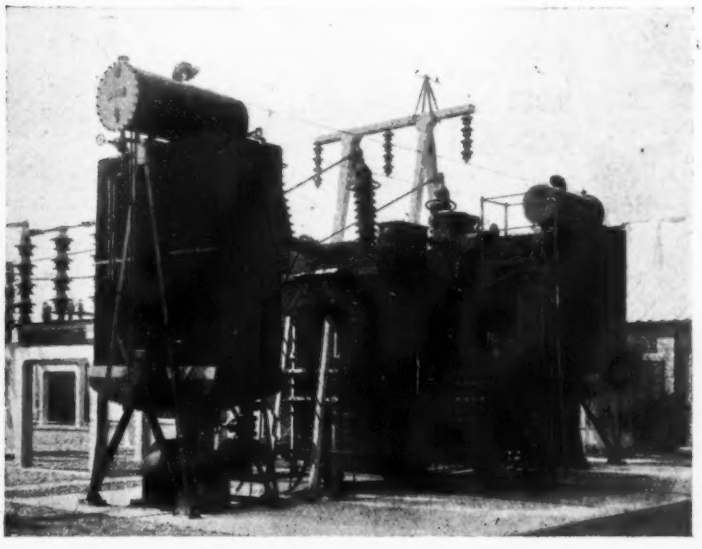

60,000 KVA 132,000 VOLT 3 PHASE UNIT

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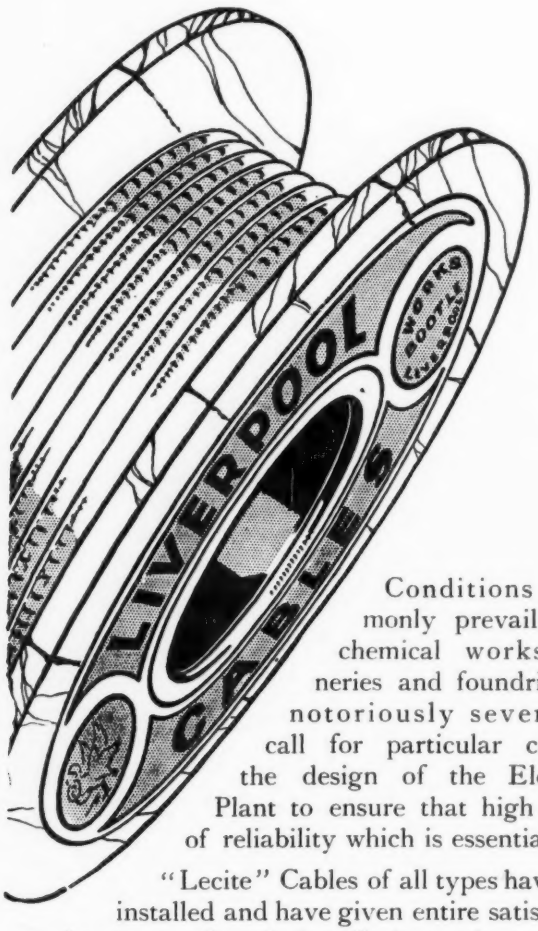
TRANSFORMERS



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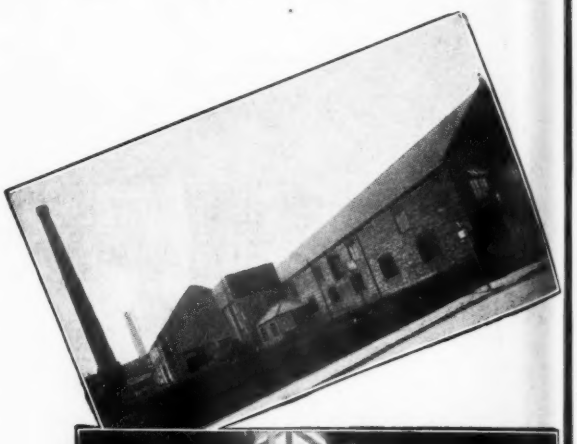

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Because of the principle of operation involved, Autovalve Arresters do not deteriorate. They have no solid or liquid dielectric to replace—air is the only active element.

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Cables: "WEMCOEXPO," New York or London.

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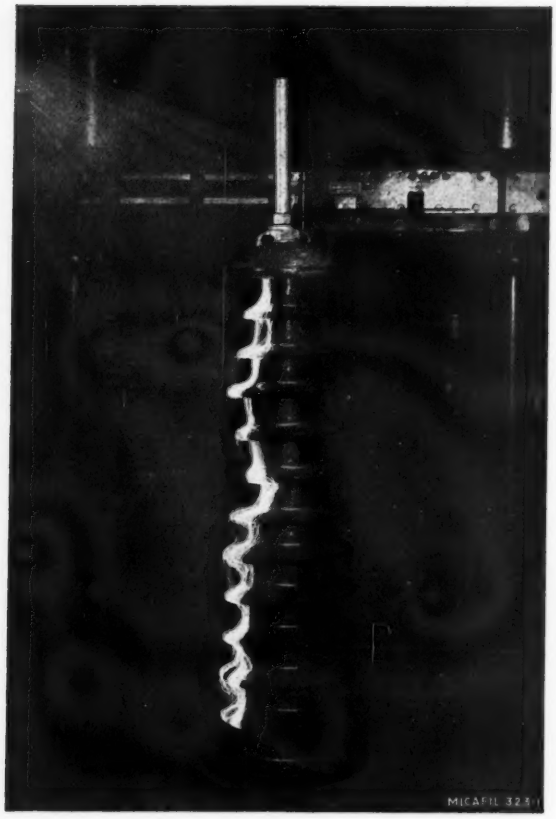

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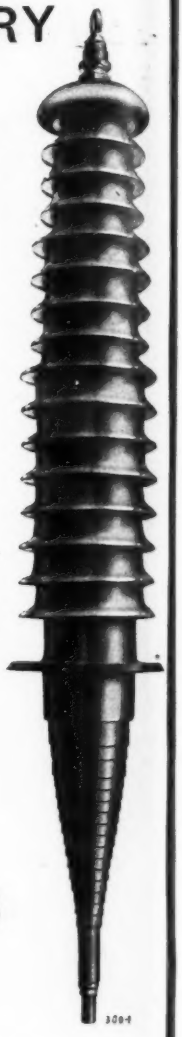

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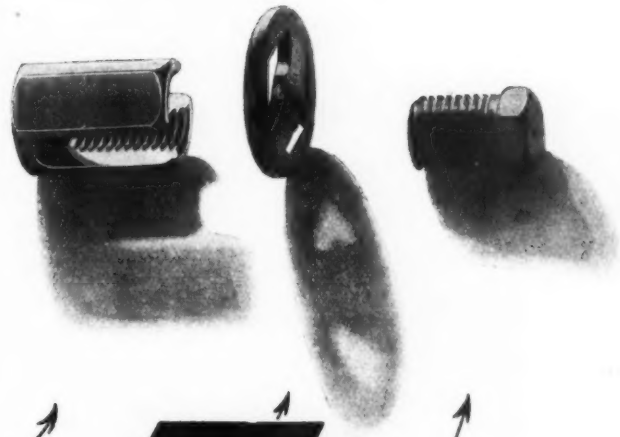

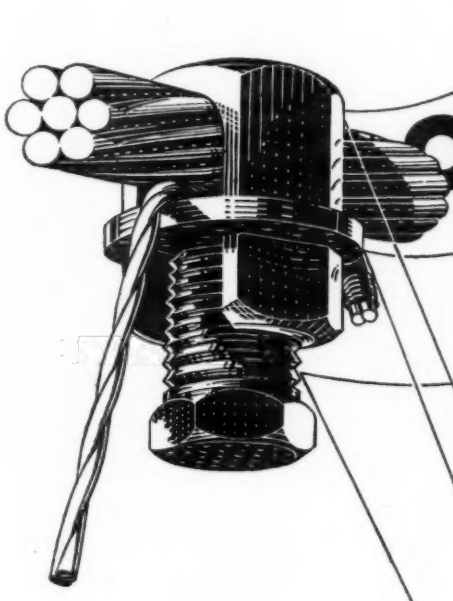

ONLY 3 PARTS

THE NEW HENLEY LINE TAPS

CONSIST OF ONLY THREE PARTS

ONE The nut-shaped Body. This is machined from the solid and slotted to receive the line and service wires.

TWO The special arched Washer. This acts as a lock washer and prevents the tap working loose under vibration. It is grooved to locate the service wire.

THREE The heavy brass Clamping Screw. This engages in the body and tightens the washer against the service wire.

All three parts are made of brass tinned all over.

DEFY VIBRATION

WRITE FOR DESCRIPTIVE PAMPHLET U.M.C.

HENLEY

NUT TYPE LINE TAPS

(PROVISIONAL PATENT No. 39452/29)

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., HOLBORN VIADUCT, LONDON, E.C.1

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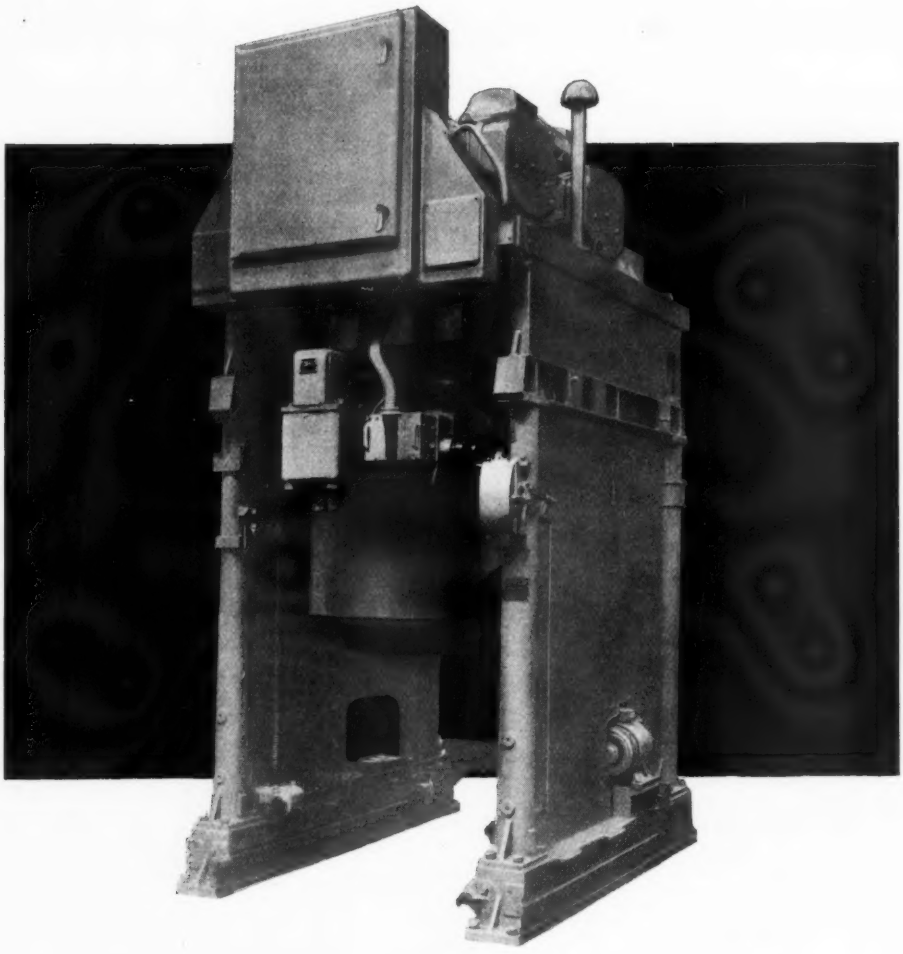

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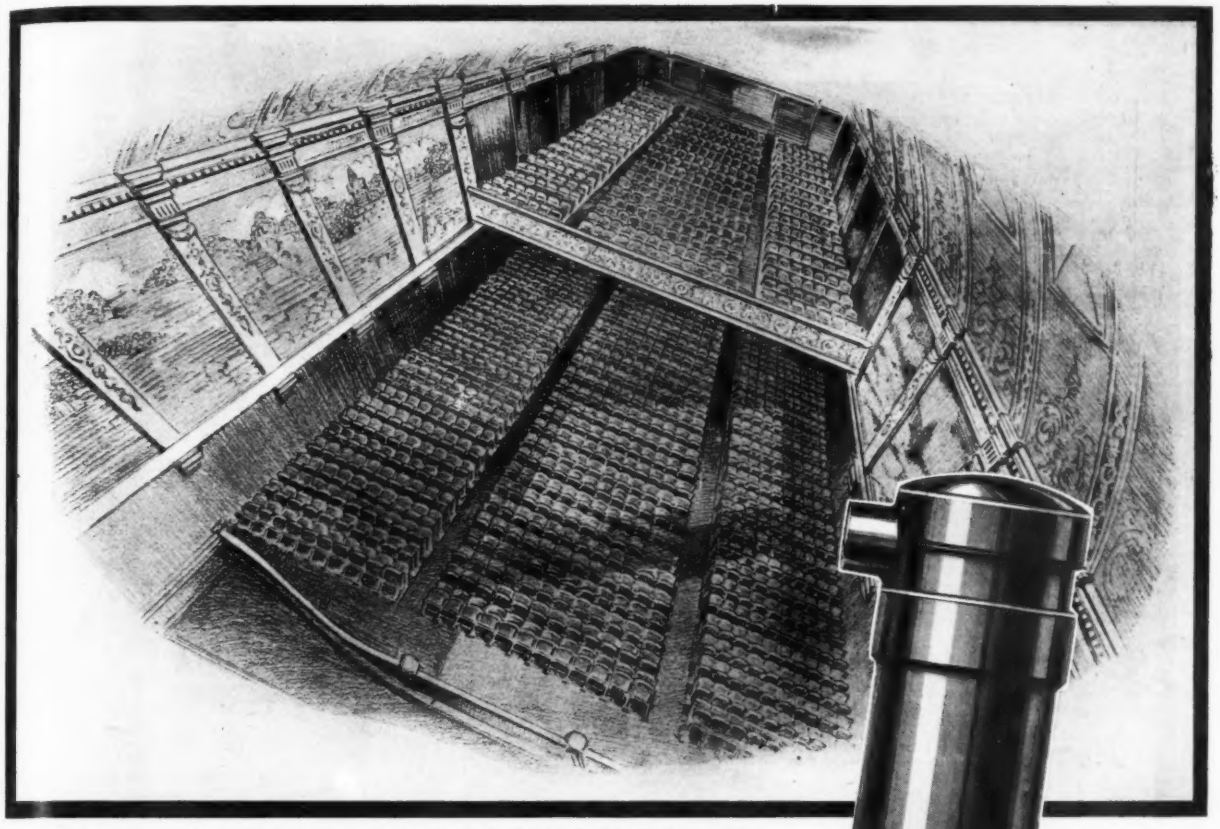
WE have become accustomed to the massive construction of Central Station and large Distribution Station metal-clad switchgear. The superstructure, in the form of pedestals, busbar and transformer chambers, comprises the bulk of the equipment, and while it is certainly important, THE thing that matters is the circuit breaker.

Recognising this, Ferguson, Pailin, Ltd., have made the circuit breaker their chief study in switchgear design; the "R" breaker is built up on actual short circuit test data.

FERGUSON, PAILIN LTD.

HIGHER OPENSHAW MANCHESTER

F.P.252



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Every individual in an audience

constitutes a potential heater

That is the problem which must be solved by any heating installation for churches, public halls, theatres, etc. A comfortable temperature must be attained before people enter. Variation is necessary as soon as the building fills.

HALF PRICE

In the past year, demand has trebled and 'UNITY' prices are now halved.

HALF CURRENT COST

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HALF CURRENT CONSUMPTION

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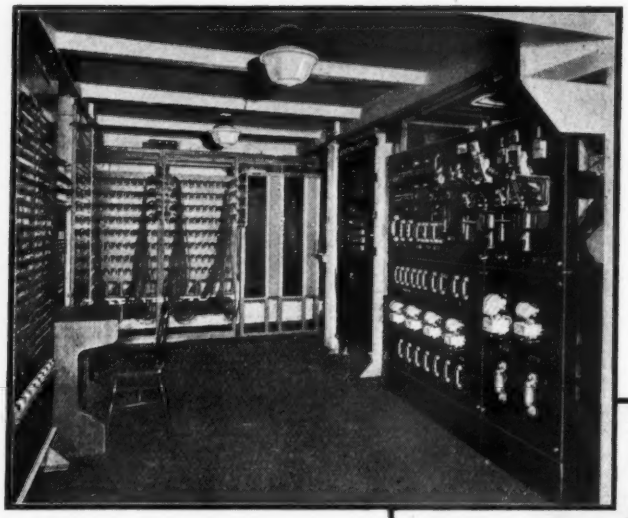
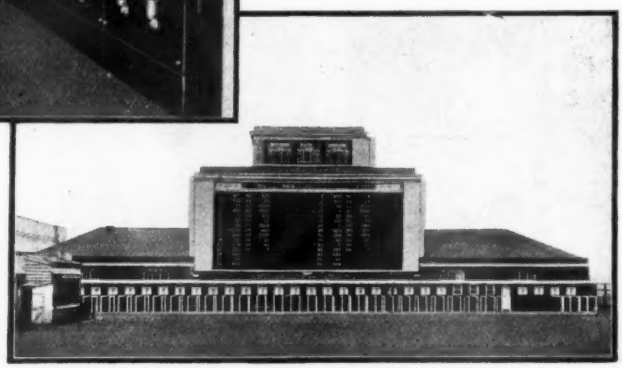
Electric Heating

Ogden's



Power and Control Switchboards built up on Ebony "Sindanyo" Panels installed in the Newmarket Totalisator. By courtesy of the A.T.M. Co. Ltd.



A general view of the All-Electric Totalisator on the Rowley Mile Course at Newmarket. By courtesy of the manufacturers—the Automatic Telephone Manufacturing Co. Ltd.

"Picking the winners" with certainty

Though associated with so highly a speculative business, there must be no element of 'chance' in the actual operation of the Totalisator. Its action must be a 'dead cert', every time.

That is why, among many other considerations, the manufacturers of the ingenious and tremendously complicated machine shown above, decided upon "Sindanyo" Insulating Board, for the necessary Switch and Control Panels.

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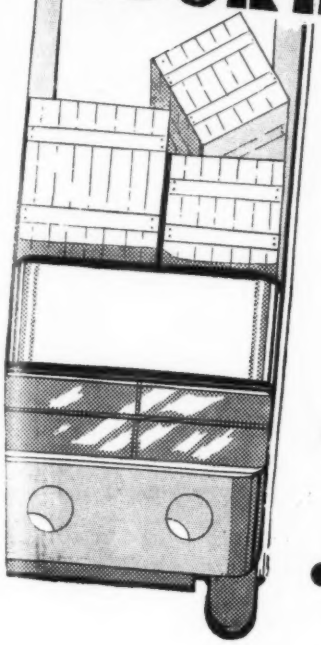

No matter what batteries provide the power for your electric vehicles, trucks or locomotives, those made by Britannia will do the job more efficiently and more economically.

TYPE VA4.
Capacity 120 A.H. at the 5-hour rate of discharge.

- **VERY SOLID CONSTRUCTION, SPECIALLY DESIGNED TO RESIST VIBRATION AND SHOCKS.**
- **VERY HIGH RATE OF CHARGE AND DISCHARGE CANNOT HARM THEM.**
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- **LOW MAINTENANCE COST.**
- **PLATES GUARANTEED FOR THREE YEARS.**

NEXT TIME ASK BRITANNIA TO QUOTE.

Britannia Tubular Batteries

IN PRICE, IN QUALITY, IN DEPENDABILITY ARE UNAPPROACHABLE.

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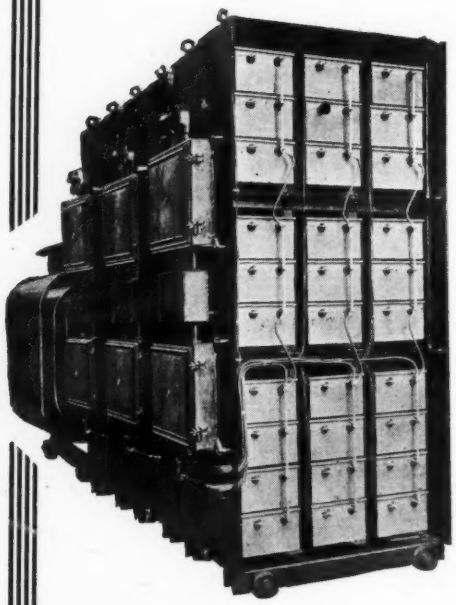
Telephone: TEMPLE BAR 7971 (4 lines). Works: REDDITCH.

"The batteries you can trust"

B

Reduce your *current* expenses!



Are you taking your current at a low power factor? If so, you may be wasting hundreds of pounds through increased losses in cables, transformers, motors, etc., resulting in decreased efficiency of your plant and consequently lower output.

By installing

DUBILIER CONDENSERS

for Power Factor Correction you can take your current at a high power factor, for which your Supply Company will give you preferential rates. What you will thus save on current costs in little over a year will completely cover the cost of the Condenser installation.

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For many years Dubilier have been recognised as the pre-eminent manufacturers of Condensers for every commercial use. In both design and construction their Condensers are mechanically perfect and give the highest electrical efficiency.

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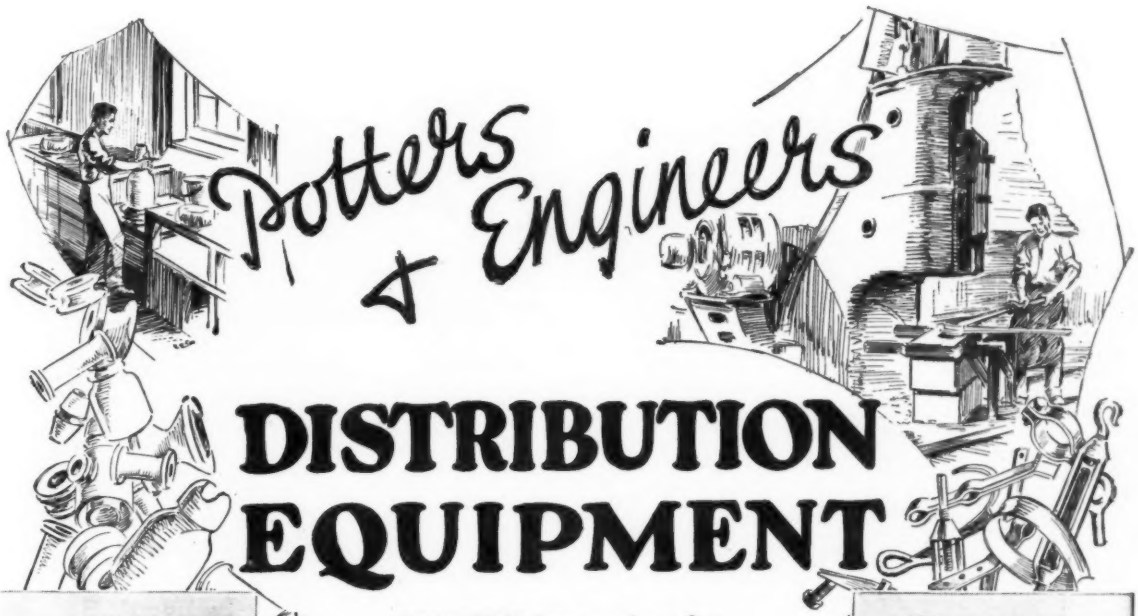

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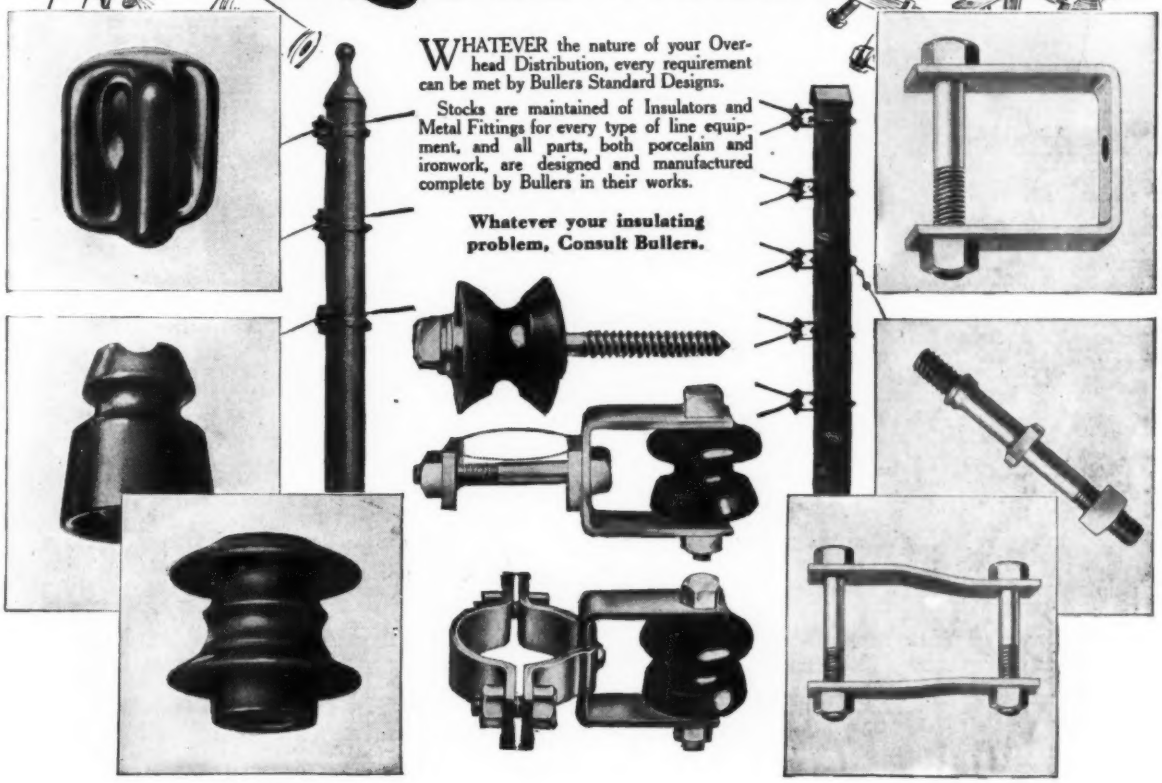

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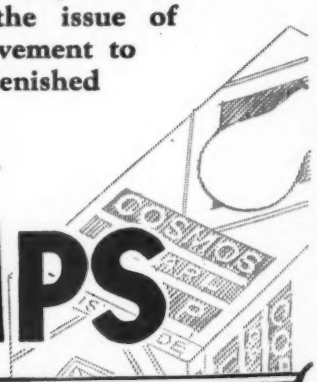

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ELECTRIC **SANGAMO** METERS

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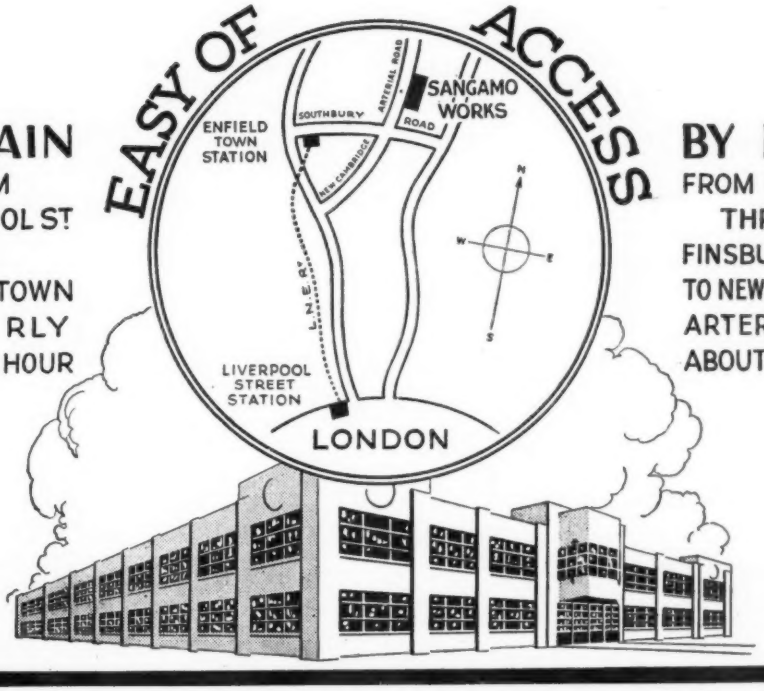

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3352 VOLTS PER MIL

and after 48 hours' immersion in water

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AT ALL WORKING TEMPERATURES AND UNDER VERY EXACTING CONDITIONS.

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DRAINS WELL. CLEAN IN WORKING.

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ALL SPRAYED LAMPS FOR RICHNESS OF COLOUR.

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One pint of **"Shaydolite"** will cover about 200 lamps.

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OIL-PROOF. FLEXIBLE.
Prevents Sparking at Commutator Ends.
Breakdown Voltage 3,600 Volts p·0·1 mm.

Suitable for HARD-WORKED TRACTION MOTORS.

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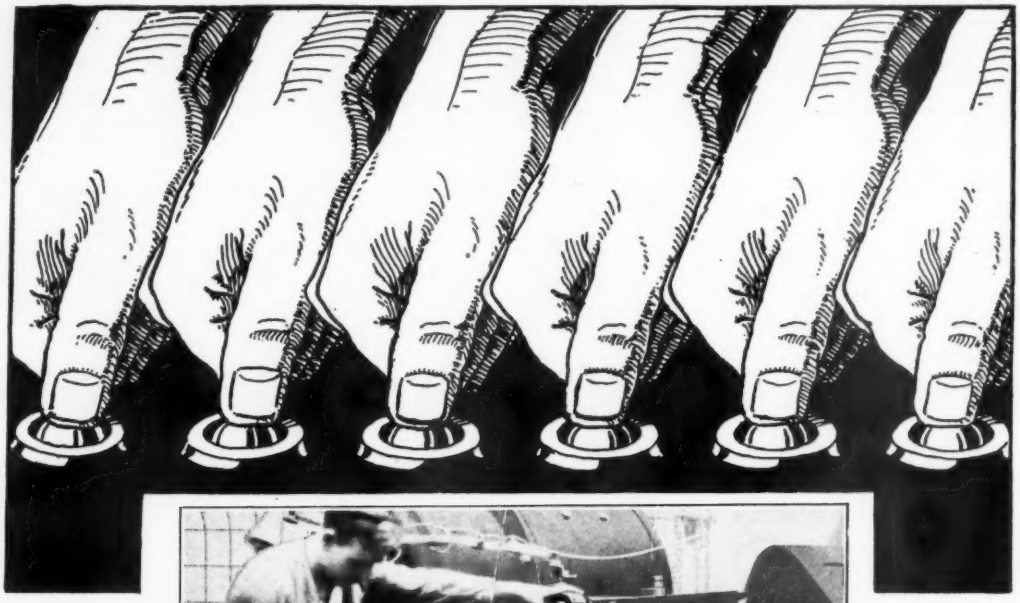

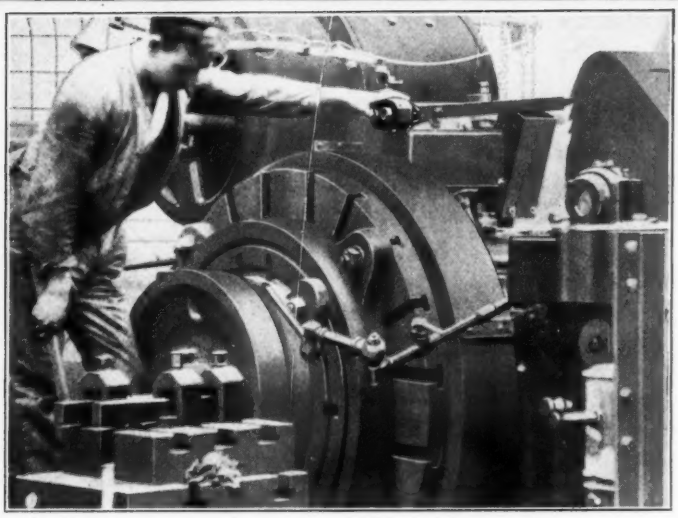

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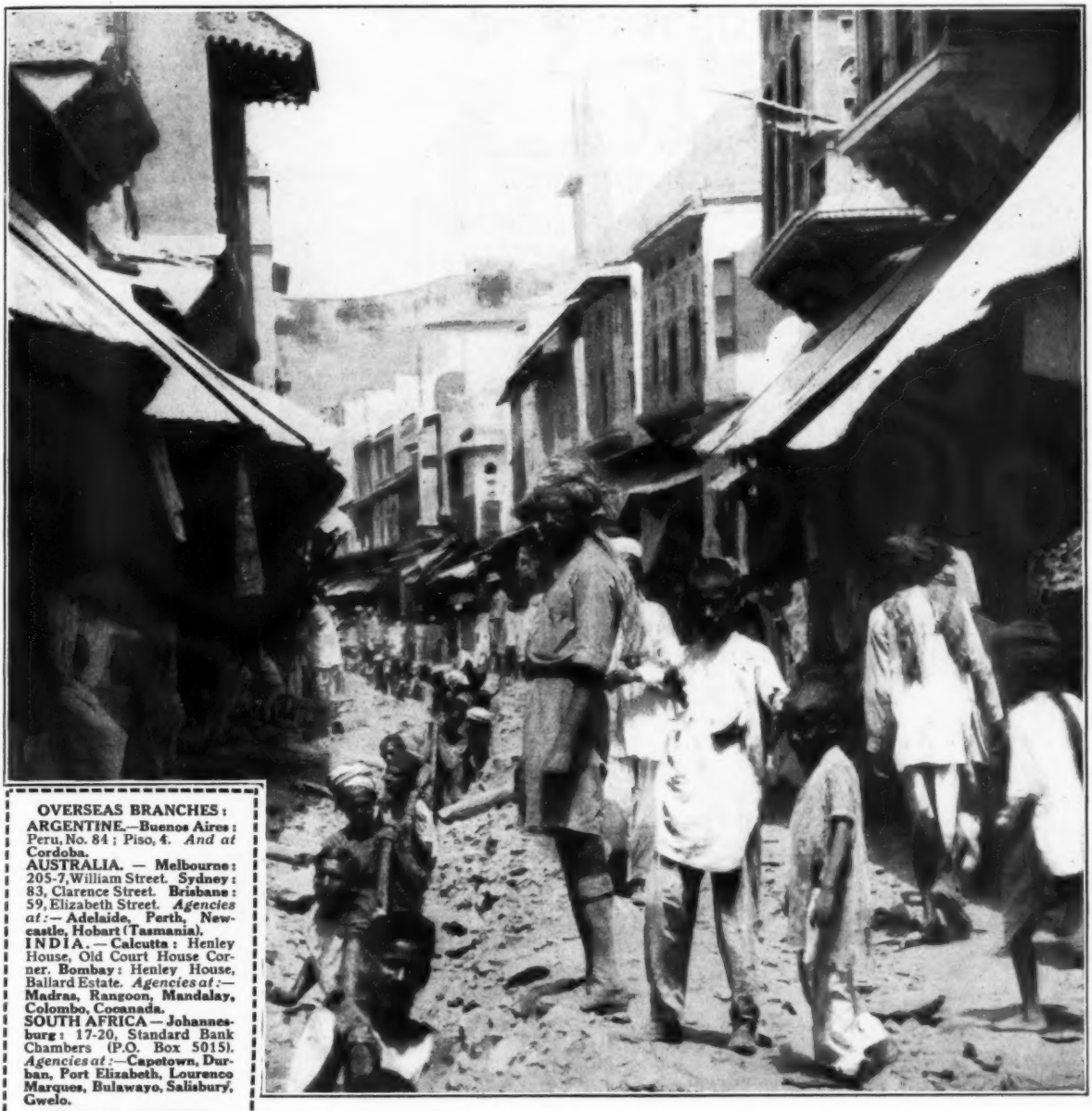

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843

They dress like this in India

But it doesn't matter a lot what men wear to lay a length of cable, for the cable is the thing. Let the method of installation vary with the varying conditions of various countries, let the scene be picturesque or drab, but always

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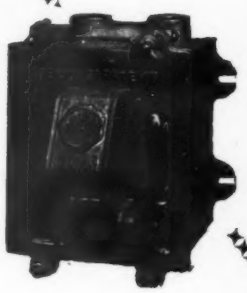

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IS IN THE **EATING—**

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A special line of WESTON Wattmeters has been designed for measurements in circuits where the power factor is very low.

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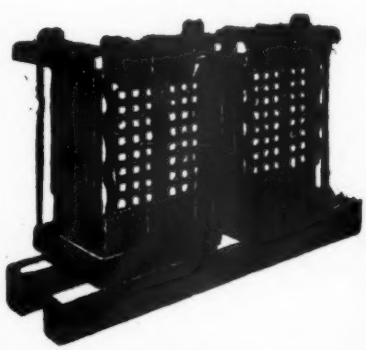

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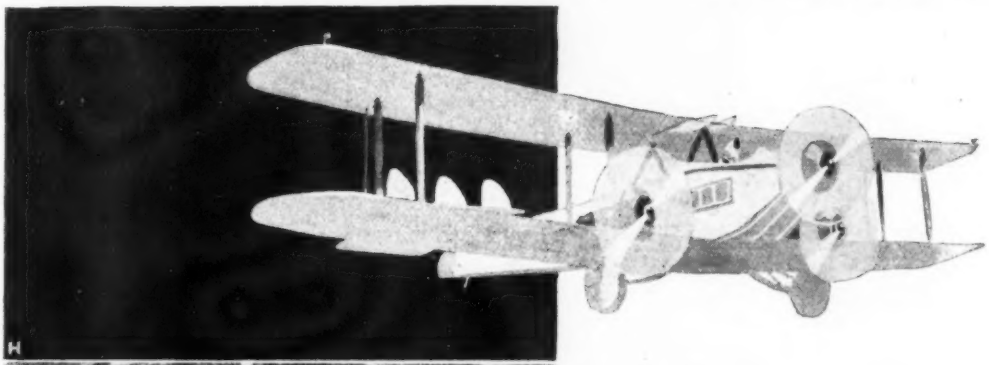

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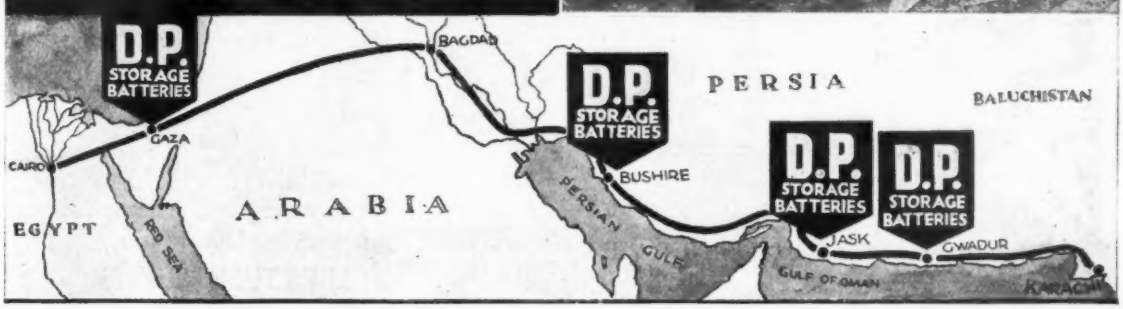

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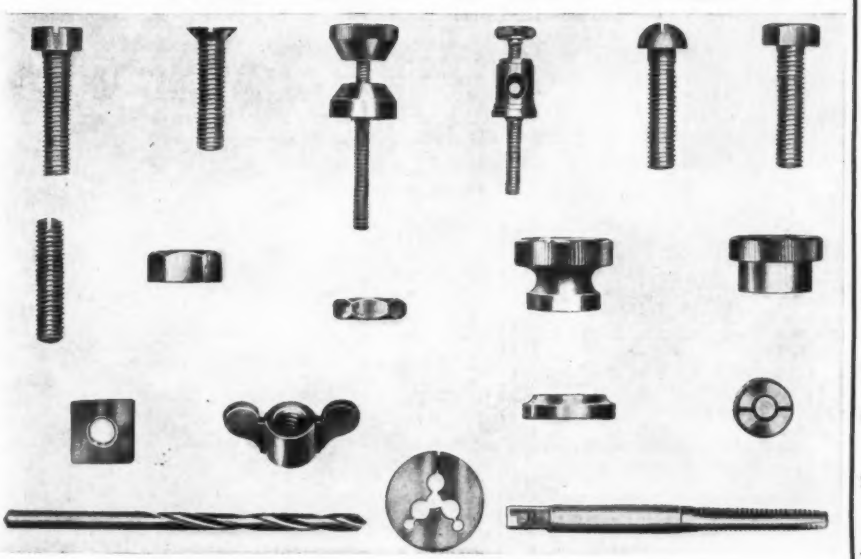

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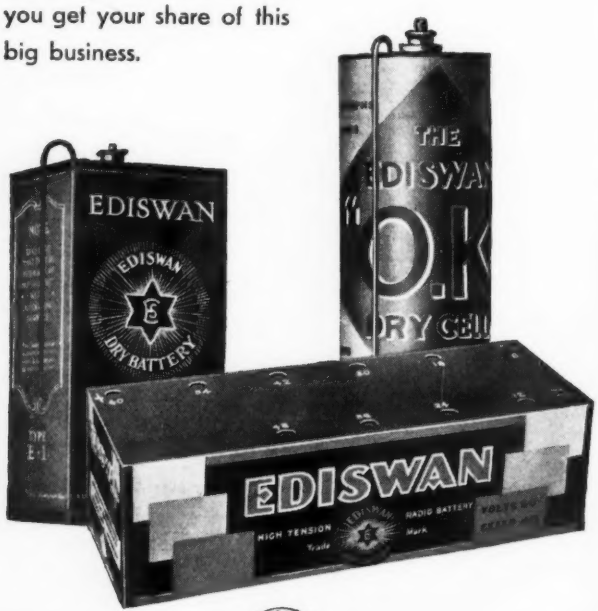

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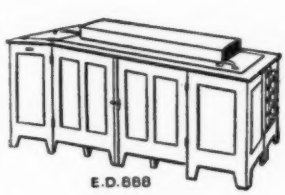
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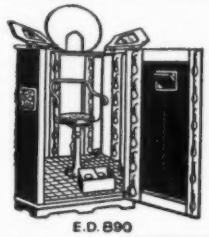
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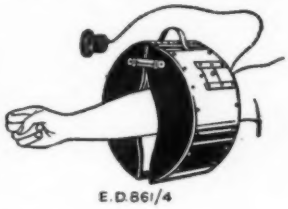
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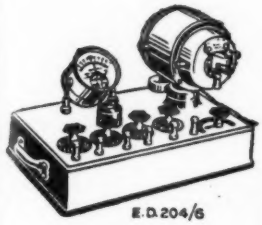
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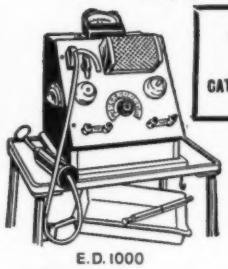
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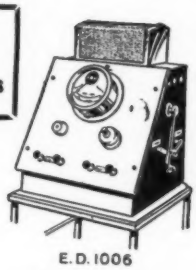
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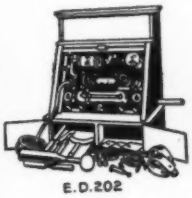
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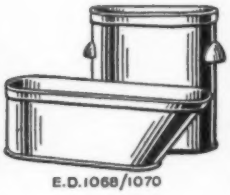
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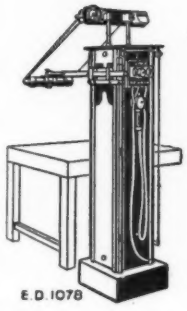
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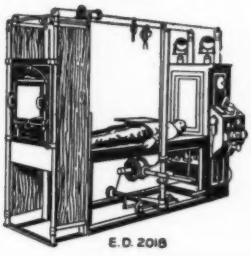
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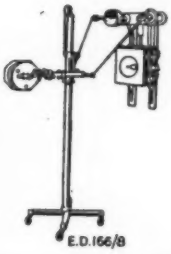
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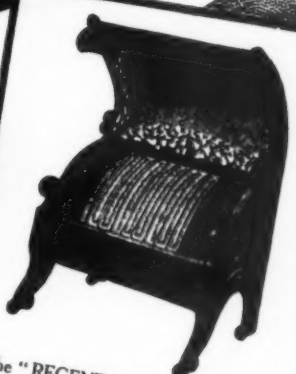

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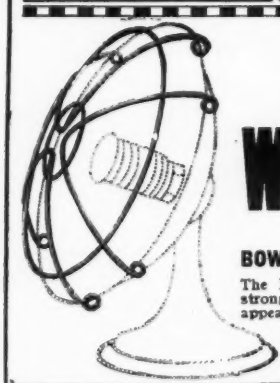

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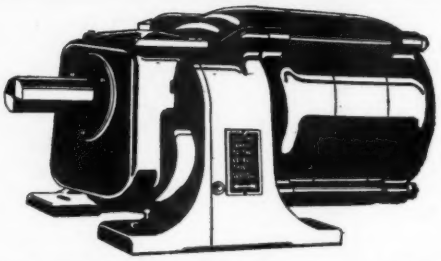

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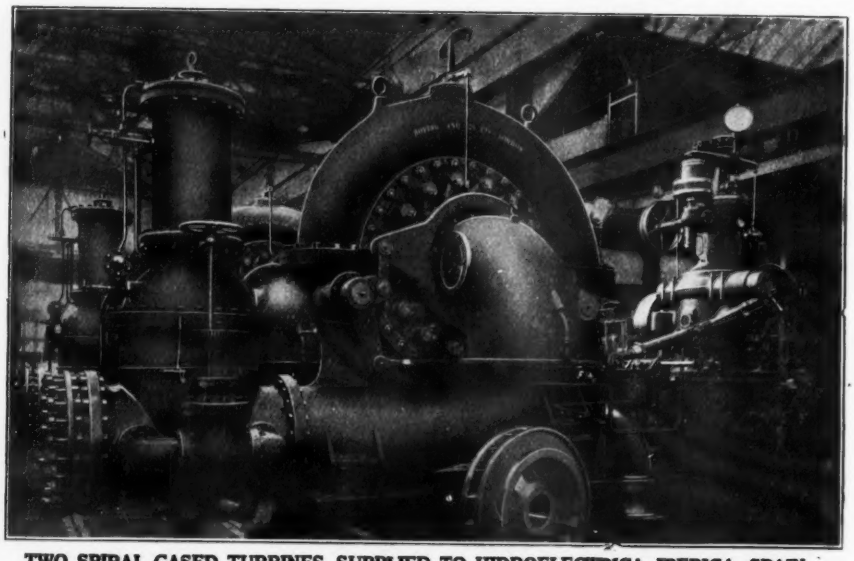

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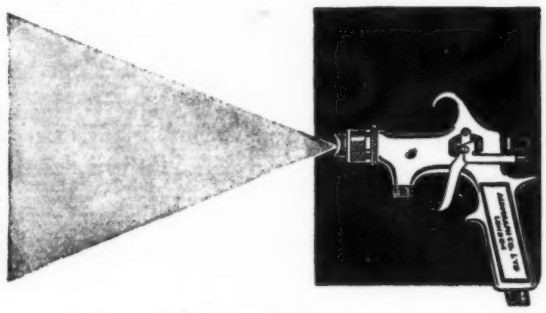

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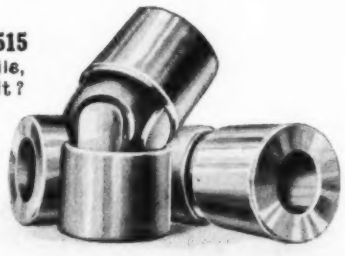

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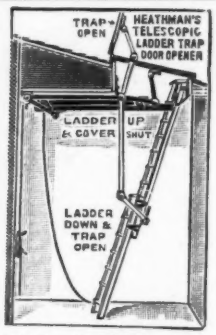

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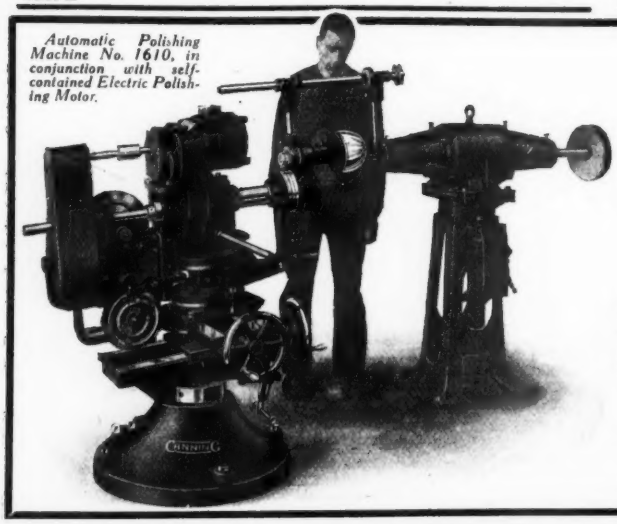

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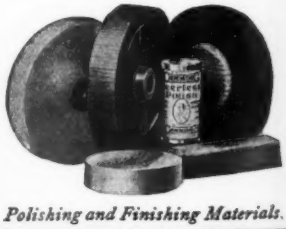

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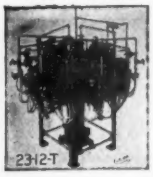

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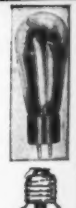

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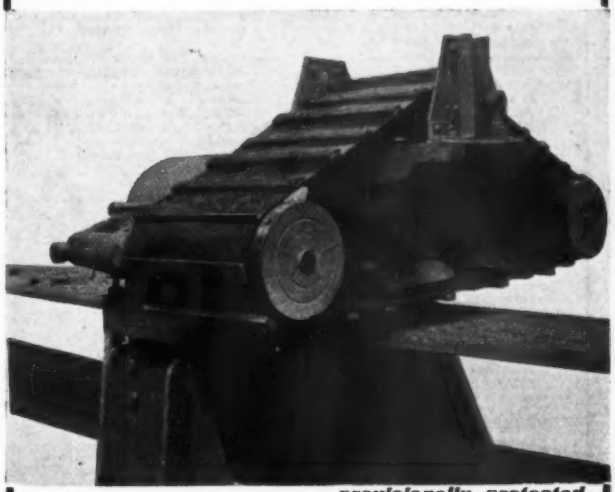

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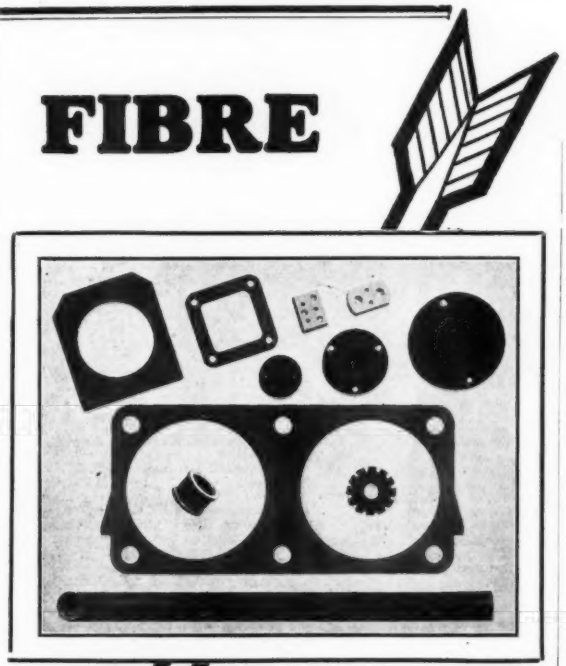

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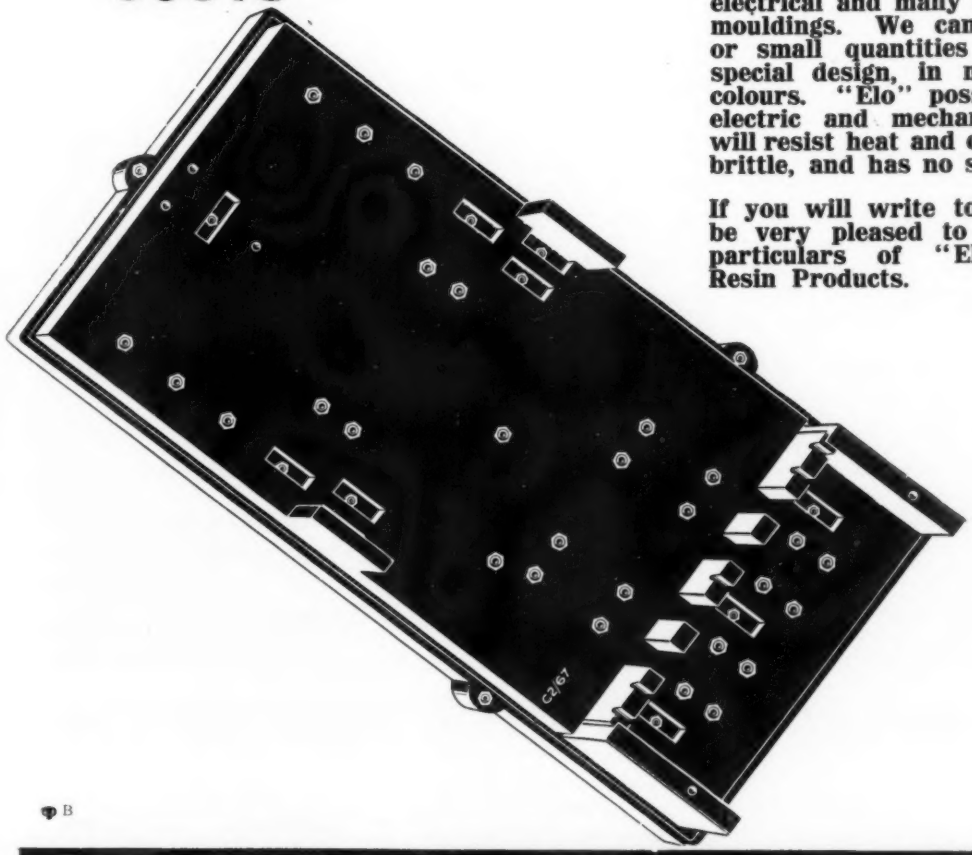

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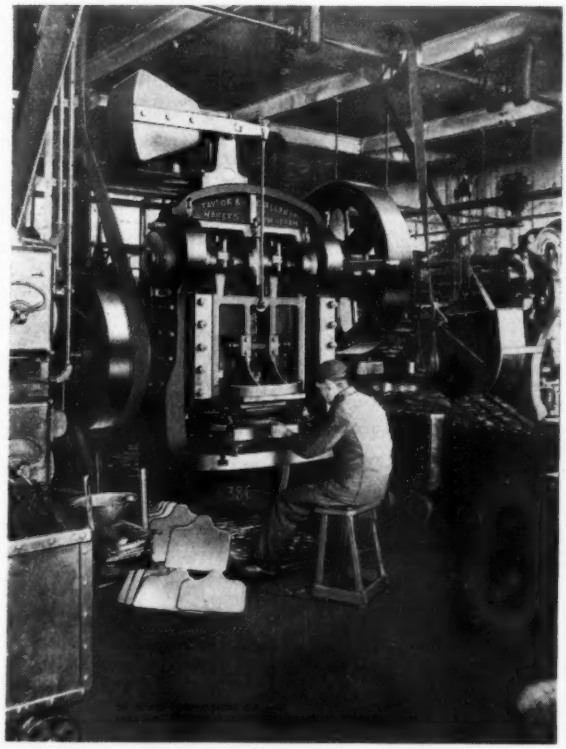

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CONTINUED ON PAGE LII.

ALTON

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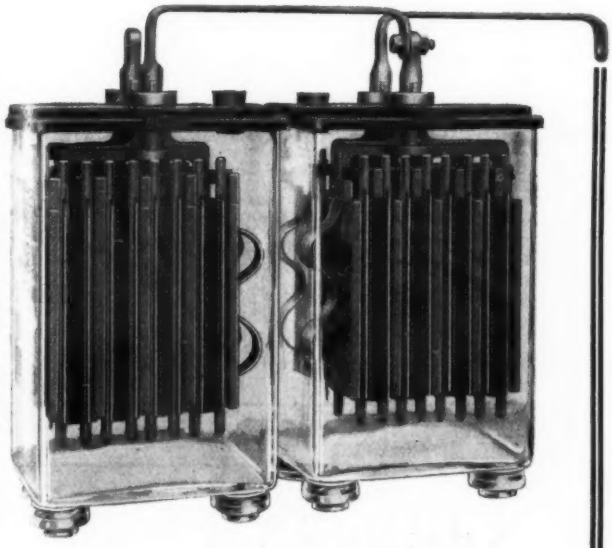

Illustration of the new ALTON Closed-Top Cell.

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THE ALTON CLOSED-TOP CELL

IN line with the progressive spirit behind ALTON Batteries of Merit, and following the constant research and improvement which is conducted, now comes the ALTON Closed-Top Cell.

It is totally different from, and in many respects altogether superior to the closed-top, or sealed-in cells now on the market.

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2. Cells are sent out FULLY CHARGED—one reason why installation costs are lower on this than on any other type of battery.

3. Specially designed packing cases simplify handling problems.

Write at once for publication 21A, which gives full particulars of this important advance in battery practice.

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MEM

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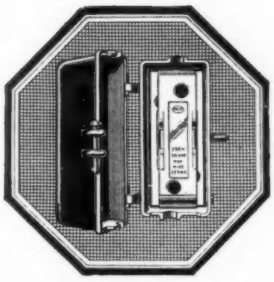

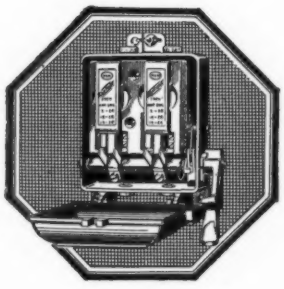

——— *worth more but costing less.*

Judged by quality, M.E.M. gear is worth more than other similar gear, but because of M.E.M. large scale standardized production, it actually costs less.

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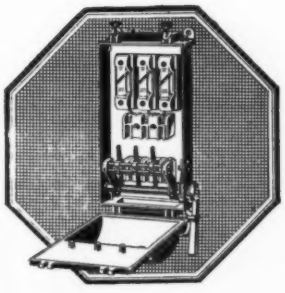
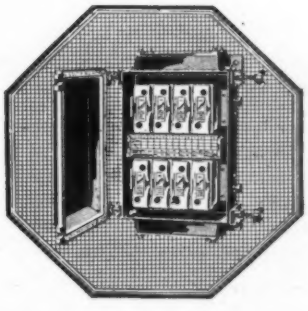
See that M.E.M. gear is used on your jobs.

All electrical wholesalers carry stocks.

MEM





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Metal Thread Screws and Repetition Work.

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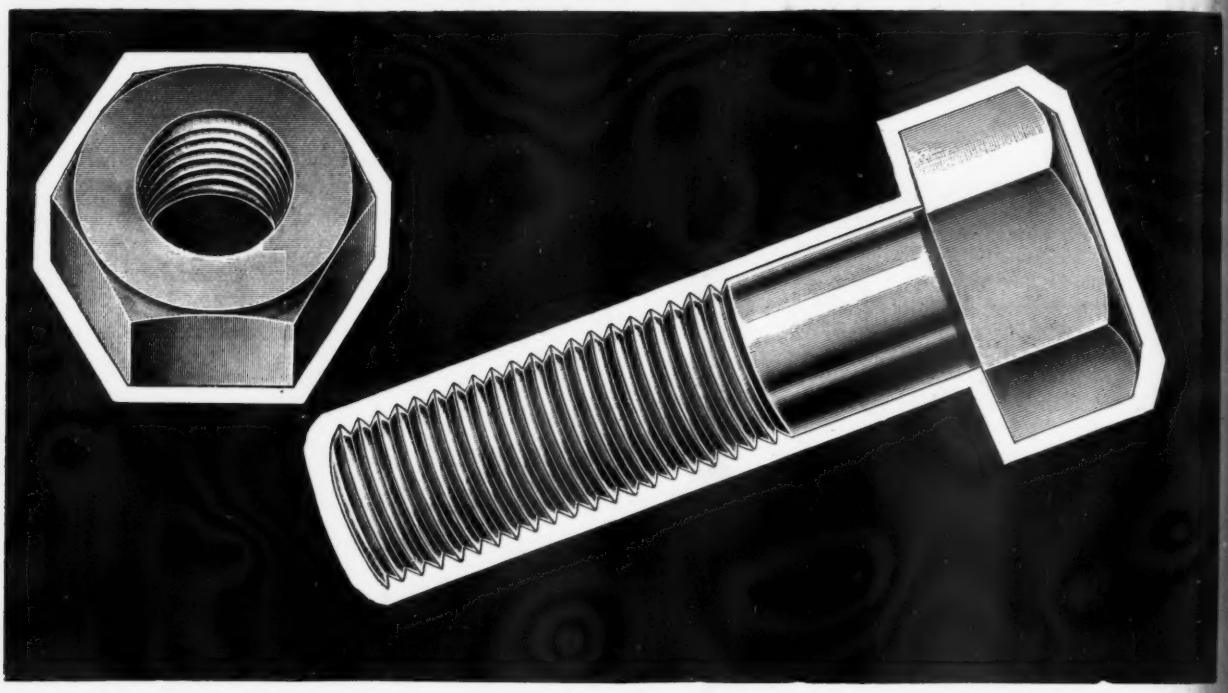
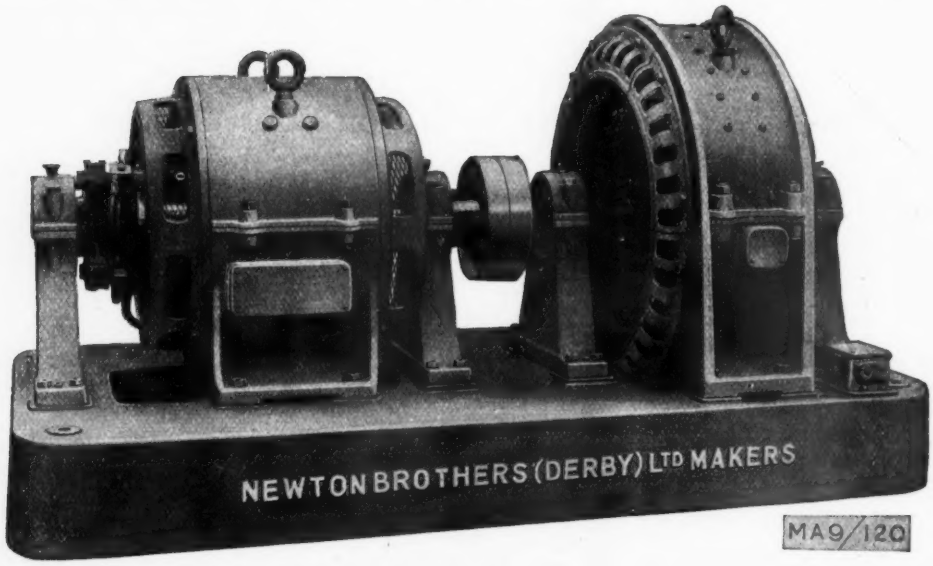


H.F. MOTOR ALTERNATORS



The illustration shows a Single-Phase Alternator of 62·5 kVA capacity, 1,000/850 Volts, 62·5 amps., 350/300 Cycles. Motor, 240 Volts D.C.

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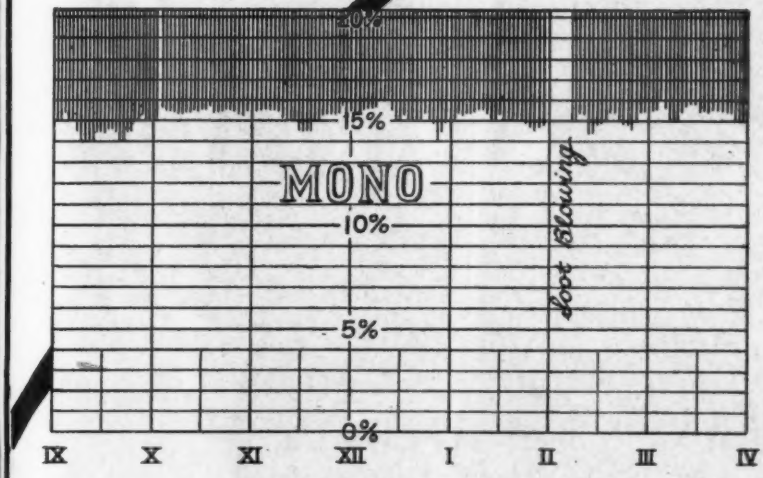

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The fact that an average CO_2 content of over 15%, without showing any unburnt gases, can be obtained with varying loads over long periods is evidence of the extreme flexibility and efficiency of the Simon-Carves plant.

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A special department of Sunco Service has been organised to deal with Xmas orders. The last minute rush is sure to come, and we strongly advise our customers to order as early as possible. Nevertheless, should you be faced with the usual frantic demand at the eleventh hour you will know that Sunco will see you through, both on delivery *and* quality.

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